MEDICAL CLASSICS

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VOL. 5

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NO. I



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CALEB HILLIER PARRY, M D , F R S

Photograph of an engraving by Philip Audinet from a miniature sketch done by John Hay Bell in 1804 Reproduced with the kind permission of Sir Humphry Rolleston and The Paul B Hoeber Co, publishers of Annals of Medical History

INTRODUCTION

The eponymic terms Parry and Graves as applied to exophthalmic goiter illustrate very well the disadvantages of the general use of proper names in classifying diseases. For many years, in English speaking countries, this type of disease of the thyroid gland has been called Graves' disease, following the proposal of Trousseau of Paris But in 1807 Sir William Osler called attention to a description of the same condition as noted by Caleb Hillier Parry in 1786 and published in Parry's posthumous writings in 1825, ten years before Graves' publication Osler suggested that the eponym, Parry's disease, be used In Germany, however, the use of the term Basedow's disease is generally accepted, because Basedow was a German In the same way we might say Flajani's, Demours', Scarpa's or Stokes' disease, because these men wrote good descriptions of the same disorder. So we have to contend not only with nationalism but with dates of observation and publication. In regard to descriptions of exophthalmic goiter, the following dates are important. Parry, noted in 1786, published in 1825, Flajani, 1802, Demours, 1821, Scarpa, 1821, Graves, 1835, Basedow, 1840 and Stokes, 1854 doubt other doctors observed the condition many years before any of these men, and it requires only a Trousseau or an Osler to popularize the use of an additional eponym for exophthalmic goiter

In Medical Classics we have not attempted to reproduce descriptions of disease because of eponymic use by modern medicine but because these writings are important landmarks in the development of medical knowledge. Parry's and Graves' descriptions of exophthalmic goiter which are reproduced here are of little practical value today, but when we examine them with a consideration of the state of medicine of the authors' day, these writings are of genuine historical significance

Caleb Hillier Parry, after completing his medical education in Edinburgh, developed an extensive practice in Bath. There he continued a boyhood friendship with that practical doctor touched with genius, Edward Jenner. We know from his writings that Parry made the most of his education in the medical school of Edinburgh and became a careful clinical observer. He was, how-

ever, a doctor whose first interest was not in writing and publishing but in observing and studying disease. He wrote an early account of angina pectoris and placed the seat of the disease in the coronary arteries. In 1814 he published a book of two hundred and eighteen pages on tetanus and rabies in man and animals, with methods of their prevention. The next year a book of twice that number of pages appeared, this one being devoted to the elements of pathology and therapeutics. A year later, in 1816, Parry published a small book on the arteries and pulse, that year he suffered a paralytic stroke and was thereafter incapacitated. Three years after his death in 1822, his unpublished writings were collected into three volumes. It is from this latter source that we here republish in its entirety Parry's description of exophthalmic goiter with the details of his cases.

Robert James Graves, in 1821 at the age of twenty-five, returned to Dublin from post-graduate study in the principal medical centers of the continent. He was soon elected to the staff of the best Dublin hospitals and became a leader of medical education and practice in that city. It is largely through his influence that bed-side teaching was introduced into the British Isles.

Graves was a famous lecturer on medical subjects, and these lectures were published in periodical and in book form. In a lecture delivered during the medical school session of 1834–1835, (Graves was then 39), in addition to a discussion of several disease conditions, Graves described a Newly observed affection of the thyroid gland in females—its connection with palpitation—with fits of hysteria. His observations were based on three cases. This lecture is here reproduced in full and gives us not only Graves' original description of the disease now known by his name but also enables us to see his attitude toward several other maladies

Graves devoted many years to the study and treatment of the numerous types of fevers then rampant in Ireland He taught that a patient with a fever should be nourished instead of being starved, as was then the custom Indeed he felt so strongly on this point that he requested for an epitaph. "He fed fevers"

This number of Medical Classics enables us not only to read two of the earliest descriptions of exophthalmic goiter but to become acquainted with two of the master practitioners of the nineteenth century, Caleb Hillier Parry and Robert James Graves

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Caleb Hillier Parry

BIOGRAPHY

- 1755 Born October 21st in Cirencester in Gloucester, England, the eldest of three sons and seven daughters of Joshua Parry, a non-conformist minister. Attended school with Edward Jenner
- 1773 Age 18 Entered medical school at Edinburgh, where he came under the influence of William Cullen
- 1775 Age 20 Moved to London to continue his medical edu-
- 1777 Age 23 Returned to Edinburgh to complete his medical studies Was elected by his fellow students president of the Medical Society of Edinburgh and was instrumental in obtaining for it a Royal Charter. This distinction of The Royal Medical Society of Edinburgh remains unique for a student society (Rolleston)
- 1778 Age 23 Received the degree of MD in June, using for his inaugural dissertation the subject of rabies. In October married the daughter of John Rigby of Manchester by whom he had four sons and four daughters Parry and his wife traveled in Holland, Flanders and France
- 1779 Age 24 Established a practice in Bath and became the most prominent physician of that region Shortly after settling in Bath he became physician to the Puerperal Charity
- 1786 Age 31. Observed his first case of exophthalmic goitre but the description was not published until 1825, three years after Parry's death
- 1789 Age 34 Became physician to the Casualty Hospital

- 1798 Age 43. Edward Jenner's book Inquiry into the cause and effects of the variolae vaccinae, published in this year is dedicated to "C H Parry, M D at Bath, my dear friend"
- 1800 Age 45. Elected a member of The Royal Society and a member of the Society of Natural History of Gottingen.
- 1808 Age 53. Became an honorary member of the Farming Society of Ireland
- 1816 Age 61 Suffered an epileptic stroke while experimenting with sheep and rabbits on the nature and causes of the arterial pulse.
- 1822 Age 67 Died March 9th in Bath and is buried in the Abbey Church at Bath

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Diseases of the Heart*



nlargement of the Thyroid Gland in connection with Enlargement or Palpitation of the Heart—Case I—There is one malady which I have in five cases seen coincident with what appeared to be enlargement of the heart, and which, so far as I know, has not been noticed, in that

connection, by medical writers The malady to which I allude is enlargement of the thyroid-gland

The first case of this coincidence which I witnessed was that of Grace B, a married woman, aged thirty-seven, in the month of August, 1786 Six years before this period she caught cold in lying-in, and for a month suffered under a very acute rheumatic fever, subsequently to which, she became subject to more or less of palpitation of the heart, very much augmented by bodily exercise, and gradually increasing in force and frequency till my attendance, when it was so vehement, that each systole of the heart shook the whole thorax Her pulse was 156 in a minute, very full and hard, alike in both wrists, irregular as to (p 112) strength, and intermitting at least once in six beats cough, tendency to fainting, or blueness of the skin, but had twice or thrice been seized in the night with a sense of constriction and difficulty of breathing, which was attended with a spitting of a small quantity of blood She described herself also as having frequent and violent stitches of pain about the lower part of the sternum

About three months after lying-in, while she was suckling her child, a lump of about the size of a walnut was perceived on the right side of her neck. This continued to enlarge till the period

^{*}Printed in Elements of Pathology and Therapeutics, 2 111-128, 1825

of my attendance, when it occupied both sides of her neck, so as to have reached an enormous size, projecting forwards before the margin of the lower jaw. The part swelled was the thyroid gland. The carotid afteries on each side were greatly distended, the eyes were protruded from their sockets, and the countenance exhibited an appearance of agitation and distress, especially on any muscular exertion, which I have rarely seen equalled. She suffered no pain in her head, but was frequently affected with giddiness.

For three weeks she had experienced a considerable degree of loss of appetite and thirst, and for a week had cedematous swelling of her legs and thighs, attended with very deficient urine, which was high coloured, and deposited a sediment. Until the commencement of the anasarcous swellings, she had long suffered night sweats, which totally disappeared as the swellings occurred. She was frequently sick in the morning, and often threw up fluid tinged with bile.

(p 113) She nursed for a year the child of her first lying-in, during which time she did not menstruate. Subsequently to that period she had five times miscarried, and for the last four months her menses had been irregular as to intervals, and defective in quantity and colour. Bowels usually lax, and more especially so for the last three weeks. It was directed that six ounces of blood should be taken from her arm, and that she should take twice a day a pill consisting of dried Squill, and quicksilver triturated with Manna, of each one grain

The bleeding almost immediately relieved the dyspnæa and stitches across the sternum. But the ædematous swellings were increased, and the urine did not exceed half a pint in twenty-four hours. She had been purged seven or eight times each day. Her pulse was 114, full and hard, and never more than six strokes without intermission. This was the state of symptoms on the 16th of August. The bleeding was ordered to be repeated, and the pills to be continued.

I did not again see her till the 25th, when she had taken eight of the pills, which did not affect the mouth, but had produced seven or eight watery stools daily The urine, however, did not

amount to three ounces in the twenty-four hours, and was very high coloured, and extremely turbid on standing, with a copious sediment. Her drink was about a quart in the day. Each systole of the heart shook the whole trunk of the body. The ædema had extended itself nearly to the navel

The pills were repeated, and she was ordered to drink freely of a solution of supertartrate of Potash

(p. 114) From this time no farther application was made to me respecting this patient, who, probably, soon paid her debt to nature

Case 2—Aug 22, 1803 Elizabeth S, aged twenty-one, was thrown out of a wheel chair in coming fast down hill, 28th of April last, and very much frightened, though not much hurt From this time she has been subject to palpitation of the heart, and various nervous affections. About a fortnight after this period she began to observe a swelling of the thyroid gland, which has since varied at different times, so as to be once or twice nearly gone. It is now swelled on both sides, but more especially the right, without pain or soreness on pressure. The pulsation of the carotids is very strong and full on both sides, but evidently in the greatest degree on the right. Menses regular, and bowels uniformly open. She voluntarily tells me that she used to be very subject to headachs, which have ceased ever since the commencement of these swellings. Pulse 96, small, hard, and regular.—Mitt Sanguis è Brachio ad 5x

Her head was much relieved by the blood-letting, and the swelling of the thyroid gland was evidently diminished

On the 25th, she was ordered to take thrice a day a teaspoonful of a mixture of Tincture of Digitalis thirty drops, Syrup of Squills an ounce and a half

Aug 31 The medicine made her sick on the second day, but she has continued it ever since without the same effect. Her bowels have been regularly purged once or twice a day, but the palpitation of the heart has been frequent, especially on exercise, which much fatigues her Swelling of the thyroid, and beating of the carotids, much as before Pulse 96 Mitt^r Sanguis ad 5x—Pergat in usu Syrupi, 4^{ter} in die

(p. 115) Sept 7. Bowels open. No sickness. Palpitation somewhat better Swellings nearly as before, that on the right being still the largest, and the pulsation of the carotid on that side the greatest —Pergat.

Sept 14. All complaints nearly gone Bowels open without sickness Pulse about 72, and slightly irregular as to the force of the strokes Pulsation of the carotids still too strong Swell-

ings lessened. Menses adsunt —Pergat in usu Syrupi.
Sept 24 Yesterday morning she was seized with giddiness and sickness without vomiting Bowels open yesterday, and frequently to-day On the 14th ultimo, she was menstruating, and continued to do so for three or four days, during which the swelling of the thyroid almost disappeared, but has since returned, and the beating of the carotid is very strong. She has at this time some catarrh with sore throat -Pergat in usu Syrupi.

Oct. 1 The symptoms of catarrh are gone, and the swellings are again very much lessened, though the pulsation of the carotids, especially the right, is still too strong. That of the heart, on exercise, is much diminished. Two stools daily, less loose than

before —Pergat in usu Syrupi cum Tincturæ Digitalis 31

Oct. 5 Beatings continue less Swellings as (p 116) before.

Bowels open Omittatur Syrupus —Let the part be frequently

washed with lukewarm salt and water

Oct 12. Last week, previously to menstruation, the swelling much increased, but when the menses appeared, it diminished, and continues to be so. Palpitation of the heart on exercise lessened, but the beating of the right carotid is still preternaturally strong.—Syrupi ultimo præscripti sumat 51 4^{tor} indies.

Oct. 19 Swelling softer and less than it has before been

Pulsation of the right carotid still strong and bounding Two or

three motions daily Pulse 108, and soft Feet cold

Case 3.—Mrs K, aged about fifty, a very thin woman, had for many years laboured under violent and often irregular action of the heart, accompanied with more or less of shortness and difficulty of respiration. During several aggravations of this disease I attended her, and found her heart violently palpitating, so as to reach 136 beats in a minute, extending its throbbing both downwards and on the right of the thorax, far beyond the due limits, and swelling in a preternatural degree all the arteries which were capable of being felt, and more especially the carotids. The pulse was often unequal both as to frequency and sgrentth. The respiration was greatly hurried, and the head was affected with throbbing pains. The urine was often defective. All muscular exertion aggravated the symptoms, which were occasionally relieved by blood-letting, Squills, Digitalis, and aperients. Still, however, much of the malady continued (p. 117), and I could never perceive that the pulse was reduced below 120 in a minute

Mrs K was also long affected with an extremely large swelling of the thyroid gland, which began at a period, the relation of which to the commencement of the disorder of the heart, she was unable to recollect

My last attendance on her was in June 1813, on the 24th of which, at eight in the morning, I was called to visit her, and found her in bed Her pulse was 132 in a minute, and very full, hard, and strong, both in the radials and carotids The beating of the heart extended all over the thorax, and even into the right hypo-The respiration was 24 in a minute, with grunting expiration, and with no elevation of the diaphragm during inspiration She had occasional cough, with yellowish brown mucous expectoration The thyroideal swellings projected before the carotids, and involved the sterno-mastoid muscles from their lower insertion to nearly two-thirds of their length upwards The carotids were driven somewhat forwards, and much enlarged, and the external jugulars were swelled and prominent about a fortnight she had been affected with an ædematous swelling of her legs, which had gradually increased The abdomen was also tense, but not fluctuating, and she suffered considerable pain about the navel, where there was soreness on The bowels had however been open during the night, with griping The quantity of urine had not exceeded a teacup full in the last forty-eight hours Some medicines (p 118) were given, which it is needless to specify, as the patient died at five o'clock the next morning A dissection was not permitted

Case 4—A woman servant, unmarried, and about thirty years of age, whom, during a space of several months, I had at various

times seen labouring under a palpitation of the heart, which always more or less existed, and was accompanied with a very quick and irregular pulse, great hurry in breathing on any exertion, and an extremely strong beating of the carotid arteries, began at length to have enlargement of the thyroid gland, which had not existed more than a fortnight, when I last saw her, and which was much increased from the time when it was first noticed

Case 5—During my attendance on this patient, I was consulted by a married Lady, of about forty years of age, from the North of England, who was supposed to be in a consumption. She had in fact a very quick pulse, with great shortness and difficulty of breathing, and frequent cough, attended with copious expectoration. She had also an extremely large swelling of the thyroid gland on each side of the neck, with a considerable dilatation of the carotid arteries. The cough having been removed in about a fortnight by blood-letting, Squills, and Citrate of Potash, which were ordered when she first consulted me, I had an opportunity of discovering, at my second visit, that she was afflicted with a most laborious action of the heart, which, from the extent of the pulsation, seemed much enlarged, and suffered a (p. 119) great aggravation of symptoms from any muscular exertion.

This inordinate action of the heart had been of long duration, and considerably preceded the commencement of the thyroideal swelling

The patient did not remain at Bath long enough for me to know the result of the disease, which, doubtless, would ultimately prove fatal

My attendance on the three last patients having occurred at the same time, first suggested to me the notion of some connection between the malady of the heart and the bronchocele I mentioned that opinion to Mr G Norman, surgeon, to whom I shewed the lady last mentioned Shortly afterwards I expressed the same opinion to Mr Cruttwell, surgeon, to whom it then occurred that he was attending a patient with a similar coincidence, and that in her the bronchocele succeeded to the affection of the heart

Case 6—Anne P, aged about thirty, a married woman, thin, and with a very long neck, who has never had a family, five years ago, at Christmas, when affected with chilblains, for their relief

kept her feet in cold water for a quarter of an hour, which made her feet extremely cold Half an hour afterwards she was seized with a pain about the region of the heart, which was extremely violent, but unaccompanied with cough, fever, or palpitation. Ever since that period she has been subject to attacks of similar pain, which recur frequently. She has also frequent palpitations, which come on more especially after walking or any (p 120) hurry, though sometimes without any apparent cause whatever. She is often affected also with oppression of breathing, which is sometimes accompanied with globus hystericus, and obliges her to lie rather high in bed All pressure about the thorax is uneasy to her, but she lies best on her left side She is free from cough. At this moment she complains of violent pain on the sternum towards the lower part, which is not sore on pressure Pulse 112, Respiration 22. Extremities cold Skin pale is sleepy during the day, but sleeps little at night Tongue rather furred Appetite irregular Urine very various as to appear-Menses, since the commencement of the malady, defective.

During the palpitation, and indeed at other times, she has long had a violent beating in her head, and a throbbing in her neck. This day fortnight she had an unusual degree of this throbbing, accompanied with a great aggravation of a distracting pain in the head, to which she has been subject ever since she began to be ill, and which is always greatly increased by coming out of the air into a warm room. During the more violent accessions of this affection of the head, she cannot bear the least conversation, and feels as if she should die. The evening after the last described aggravation, the thyroid gland began to swell at its lower part before, and the swelling has now diffused itself to a considerable degree on each side, without soreness on pressure. The beating of the carotids is very strong.

(p 121) For a year past she has often parted with pieces of tape-worm, of various lengths, some at least a yard Bowels generally costive

She has tried various remedies for all her maladies, except the

swelled thyroid gland -Vs ad 3x11

Nov 10 The bleeding, for three or four days, greatly relieved

her It exhibited no inflammatory crust, but, in consequence of her having fainted, ten ounces only were taken away Since this operation, the thyroid gland is reduced nearly one half Pulse 144, and weak, on her coming up stairs Bowels constantly purged, and tænia has continued to come away—Vs ad 5viii

Nov. 14 The blood is reported to have a considerable degree of inflammatory crust The swelling is still farther diminished, and at the symptoms are much abated Pulse 100, soft, and regular Costive

R Aloes Barbadensis

Scillæ exsic āā Dj

Syrupi q s sit Ft Pilulæ xx æquales Sumat unam ter die

Dec 7 Her bowels have not been sufficiently open, though she has taken purging Salts every morning. She has discontinued the Pills, fancying that they have produced pain in her stomach and bowels. Ever since yesterday, she has had constant pain in her head and back, and also in her left side about the region of the heart, especially when she moves. Previously to that time she was better. She makes daily from a pint to a pint and a half of high coloured urine. Pulse 104, weak, and regular. Neck much (p. 122) reduced in size—Pergat in usu Salis, aperientis—Desistat ab usu Pilularum.

March 4, 1814 She has continually kept her bowels open by means of the Salts, and till within these six weeks has taken, thrice a day, a pill ordered since the last report, and consisting of dried Squill 5ss Barbadoes Aloes Dss. divided into xx pills

Till within this fortnight she has been much better, but, ever since that period, her breath has been very short, especially on going up hill or up stairs, and she has had a great deal of palpitation and irregular action of the heart, on any exertion, after which, if she is within doors, she is obliged to go to an open window for breath. She complains also of a beating exactly in the scrobiculus cordis, in consequence of exercise, which beating is perceptible to the touch. Pulse 116, now while at rest, and somewhat unequal in the strength of the strokes. The pulsation is perceptible by me on the outside of her clothes, considerably below the proper

seat of the heart Pulse of the carotids very strong. Swelling of the thyroid gland larger than it was, and there is a good deal of pain high up on the right side, in contact with the carotid, especially when she swallows Her left leg and foot are in some degree ædematous, especially at night A pint or more of urine daily, varying in colour Bowels bound—Mitt Sanguis è Brachio ad x—Pergat in usu Pilularum ultimo præsciptarum.

March 19 She was very faint from the bleeding; and has continued the pills, which have purged her thrice a day Pulse 120, weak, and somewhat unequal (p 123) Respiration 20 For a week past she has had a cough without expectoration, or coryza Countenance and hands livid, and extremities cold. Thyroideal swelling very much diminished, and more soft, since the bleeding, and pain of the right side of the throat gone The strength of pulsation in the carotids is greatly reduced. She complains of considerable pain about the heart, which is lessened by lying down, and of great soreness on pressure about the scrobiculus cordis. Quantity of urine not ascertained. Legs and feet less swelled than at last report—Pergat sumere Pilulas jam præscriptas

March 22 She has had two or three loose motions daily. The cough continues, with considerable expectoration in the morning The pains of the thorax and scrobiculus cordis continue. Pulse 120, weak, and unequal Respiration 18, from the thorax only, though sometimes assisted by the supra scapular muscles, and irregular as to period and depth. Urine from a pint to a pint and a half daily, and, as she tells me, clear Swelling as before —Pergat in usu Pilularum

March 25. On examining the thorax and abdomen, I find a great pulsation not only about the proper region of the heart, but also considerably below the point of the ribs on the left side, between that spot and the navel, and the part affected is extremely sore on pressure, though there is no swelling or other external appearance of disease

April 1. Urine from three quarters of a pint to a pint and a half daily, high coloured, and somewhat (p. 124) turbid Palpitation for this week pass less than it was Thyroideal swelling

much diminished Pulse 116, soft, and regular Bowels open twice a day, but not without the pills

Rept Pilulæ, ado Pil Hydrargyri Dj Sumt j ter die

Case 7—An unmarried Lady, aged fifty, who had been at various times subject to palpitation of the heart, observed by accident a swelling of the thyroid gland on the left side, about two years before I first visited her, she was not able to recollect whether the swelling or the palpitation first occurred. For the former, various remedies were for a short time employed, and at an unassignable period afterwards, she began to suffer pain in her legs, ankles, and feet, occasionally attended with some ædema of the latter part, and from this period, if not before, the swelling ceased to increase. When I examined it in the month of March 1814, it was not in the smallest degree sore to the touch. Her pulse was uniformly quick, amounting habitually to 100 in a minute, and being very strong in the carotids, more especially the left. Her appetite was good, and her tongue clean, and her skin cool

Case 8—Miss P, of a gouty and nervous family, has had an enlargement of the thyroid gland for more than twenty years, which has very much increased of late. It commenced at sixteen years, after having been two years tolerably regular, but leading a sedentary life. It is not sore, but occasionally somewhat uneasy. She has no previous headach or giddiness, but frequent palpitation of the heart, sudden, and (p. 125) violent. She is regular copiously, with no difference at these times

Eight or nine years ago a pain came on in the right foot, across the small joints of the toes, with swelling, redness, and tenderness, continuing for five or six weeks, and becoming of a dark livid colour; impeding her walking for a considerable time, without breach of the skin. From that period she has been subject to depression of spirits, and frequent headach, especially of late. The swelling began on the right side, and is now nearly equal on the left, but extending far upwards. Pulse 96, and soft. Carotids of moderate strength, the right, strongest. Palpitation less of late, but violent. Bowels tending to costiveness. Extremely nervous. She has taken Bark, Sponge, Calomel,

Antimony, Sarsaparilla, Soda, has tried sea bathing, and used Mercurial friction, which made her faint Vs ad 3viii. Aloes Barbad gr. j vel iss h r n Extr. Conii, q s ad nauseam ciendam

The blood was not inflamed A fortnight afterwards, the patient, who lives at a distance, says in a letter, "That the tightness and uneasiness in the swelled part are quite removed, but I cannot be certain the size is reduced I have taken much exercise, and feel altogether improved by your remedies—May 12, 1814"

Bronchocele, with Affections of the Head—Case I—A female of advanced age, mother of several children, apparently of weak intellects, and, as it was said, of a very fretful and captious temper, subject to headachs, and scarcely ever sleeping, began to be (p 126) affected with bronchocele before the cessation of the menstrual discharge, and afterwards suffered a slow, but gradual increase of the malady She had no affection of the heart, and her health was otherwise good. The symptoms of determination to the head, above mentioned, were capable of alleviation only from blood-letting and purging. The pulsation of the carotids was always too strong.

Case 2—A Lady, upwards of fifty years of age, for more than twenty years subject to a great variety of complaints denominated nervous, and among the rest to epilepsy, of which she has had at least five hundred fits, began, soon after the commencement of these maladies, to be affected with enlargement of the thyroid gland, which has gradually increased to a considerable extent. It has been constantly remarked by her that a sense of fulness and most conspicuous enlargement of that part takes place some days before the paroxysm, shortly after which the swelling diminishes, and is reduced nearly to the previous size. The pulse is usually at least 96 in a minute, and that of the carotids preternaturally strong. There was no evidence of mal-organization of the heart

Case 3 —Miss C, aged thirty-five, thin, and of middle height, at the time of her consulting me on the 20th of April, 1814, had been for twenty-four years subject to epileptic fits, which for

several years had occurred about every eight days, almost universally seizing her in the night, when she often had two attacks They excited no consciousness, but their frequent recurrence had produced some loss of memory (p 127), together with occasional mental alienation Her appetite was great, her strength little impaired, and her stools and catamenia were regular

Some time about the year 1808, she began to perceive an external swelling in the neck, which, when I saw her, was an evident enlargement of the thyroid gland, which had considerably increased, and affected both sides of the throat, without soreness or any other inconvenience

Case 4—In Mr E, a glandular enlargement, and inflammation in the neck, was always attended with vertigo, and sometimes with deafness. The pulsation of the carotids was very strong, and in evidence that this was not the effect of local glandular pressure on the carotids or jugular veins, the effect was just the same when the diseased gland was reduced in size

Case 5 — Jane C began to have nervous headach in May 1814, and at the same time the thyroid gland began to enlarge She is regular, but has had ovarian swelling for two years [June 22, 1814]

Enlargements of the thyroid gland are not uncommon in females about the period when the body is fully formed, and the menses are in a sort of wavering state. After both these points are completely established they generally disappear, if the health is otherwise good, and this event occurs under such different modes of medical treatment, that I have often doubted whether those modes contribute much to the effect

It is indeed true that these swellings occur most often, and in the greatest degree in young females, who have (p 128) led sedentary lives, and who are of what are called relaxed and nervous habits, in which, according to the principles which I have already endeavoured to establish, there is a propensity to morbid determinations of blood, more especially to the head. Much the worst cases of the kind which I have seen at that age, have been those so accompanied, and in more than one of these, the affection of the head has amounted almost to madness

As the determination to the head in these cases has been removed, either by evacuants, by bodily exercise, or by the spontaneous salutary changes in the constitution, the bronchocele has also ceased

I do not deny that in some examples of this kind the patient has remained subject to the determination to the head, even after the bronchocele has disappeared, nor is there any reason why this should not happen, unless the bronchocele were the cause of the determination, which is not presumed. On the other hand, cases of bronchocele have been observed to occur in the Valais, as above remarked, and also in England, without any conspicuous symptoms of too great determination to the brain

Still, however, the coincidence is so frequent and remarkable, that one can scarcely avoid suspecting that the thyroid gland, of which no use whatever has hitherto been hinted at by physiologists, is intended in part to serve as a diverticulum in order to avert from the brain a part of the blood, which, urged with too great force by various causes, might disorder or destroy the functions of that important organ

(p. 129) This notion, however, I offer merely as a conjecture, which future observation may either establish or annul





Robert James Graves

BIOGRAPHY

- 1796 Born, the son of Richard Graves, Senior Fellow of Trinity College, Regius Professor of Divinity in the University of Dublin and Dean of Ardagh
- 1818 Age 22 Received his medical degree from the University of Dublin Then studied in London, Berlin, Gottingen, Vienna, Copenhagen, Paris and in Italy During his tour of the continent, he had many adventures, among which was his arrest as a German spy in Austria because he spoke the language so well and had left his passport at his lodgings
- 1821 Age 25 Returned to Dublin and began an active practice Elected physician to the Meath Hospital, was one of the founders of the new Park Street School of Medicine and lectured at Sir Patrick Dun's Hospital
- 1835 Age 39 Described exophthalmic goiter, now known as Graves' disease
- 1843 Age 47 Chosen President of the College of Physicians of Dublin
- 1848 Age 52 Published Clinical lectures
- 1849 Age 53 Elected Fellow of the Royal Society of London
- 1853 Aged 57 Died, March 20
 - Received a fellowship of King and Queen's College of Physicians
 - Was King's Professor of the Institutes of Medicine at Dublin Medical School
 - Received the Honorary Membership of the Medical Societies in Berlin, Vienna, Hamburg, Tubingen, Bruges and Montreal

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Clinical Lectures

DELIVERED BY

ROBERT J GRAVES, M D

At the Meath Hospital during the Session of 1834-5

LECTURE XII

Persesquinitiate of Iron in Chionic Diarrhea—Blueness of the Fingers and Toes in Fever—Some Account of the Yellow Fever which prevailed in Dublin in 1827—Newly observed Affections of the Thyroid Gland in Females—Its connexion with Palpitation—with Fits of Hysteria—Erysipelas—Remarks on the Formation of Acidity of the Stomach in Indigestion—Psoriasis—Treatment by Arsenic.

ENTLEMEN,—Having lately used, with very considerable success, a preparation introduced by Dr Christison, namely, the persesquinitrate of iron, I shall make a few observations here on its properties and use

The combination of iron with nitric acid forms a remedy possessing tonic, and, at the same time, astringent powers, and hence peculiarly well adapted for the treatment of certain forms of chronic diarrhæa and dysentery. You will be consulted by females of a delicate and weakly habit, who frequently exhibit symptoms of nervous derangement, such as palpitations, sleeplessness, and headache, who are easily excited or alarmed, have a tendency to emaciation and paleness, and have little or no appetite. Combined with these general symptoms, you find that they have been labouring under diarrhæa for weeks, and even months, and that this, with the other causes of debility, has rendered their condition exceedingly uncom-

fortable You will also be informed by the patient, that she has tried many remedies without benefit, and that she is extremely anxious to have something done to give relief, and hence it is a matter of importance to be acquainted with any remedy which may be likely to prove serviceable in such emergencies

It would appear that this form of diarrhoea does not depend on an inflammatory condition of the stomach and intestinal canal, for the indications of inflammation are absent, such as pain, tenderness on pressure, thirst, redness of tongue, and severe or continued griping It would rather seem to be connected with congestion of the mucous membrane of the digestive tube of a passive nature, and resembling the scrofulous, it is also of an unmanageable character, and very seldom amenable to the ordinary modes of treatment The common astringent remedies totally fail, chalk mixture, kino, rhatany root, and catechu, are useless, and in such cases it has been observed that opium is generally injurious If you prescribe opium it certainly checks the disease for a time, but this temporary relief is accompanied by debility, malaise, restlessness, and many other uneasy symptoms, and the diarrhœa soon returns, and is as bad as ever The medicine which I have found most effectual in such cases, is the persesquinitrate of iron, in the form recommended by Dr Christison With it I have succeeded, within the last two months, in curing two cases which had been exceedingly obstinate and of very considerable duration, the disease having in one case resisted all the efforts of medical skill for seven months, and in the other for two years Seven or eight drops of the liq ferri persesquinitratis, increased gradually to twelve or fifteen in the course of the day, was the quantity prescribed in both cases In the course of four days a slight diminution of the diarrhœa was perceived, in a fortnight the patient felt much better, and in a month or five weeks it had disappeared altogether This took place without being followed by any bad effects, there was no swelling of the stomach, no tympanitis, no tormina, no restlessness or nervous derangement, the patients recovered their health and strength, and the cure was at once safe and permanent

The effect of this remedy admits of an explanation on either of two grounds. You are aware that nitric acid exercises a very

powerful influence over many morbid discharges In chronic diarrhœa or dysentery, and in a certain form of diabetes, it is one of the most (p 514) efficient and appropriate medicines which can be prescribed. We can therefore understand its peculiar adaptation to the case of which I have spoken The nature of the complaint requires a tonic as well as an astringent, and you all know that nitric acid is used as a tonic in many cases attended with debility and emaciation With respect to iron, its mode of action is equally intelligible Many of the salts of iron exert a very remarkable influence on the conditions of mucous membranes The sulphate, tartrate, and many other preparations, are prescribed with great advantage in chronic fluxes from mucous membrane, hence the benefit so frequently derived from the use of Griffiths' myrrh mixture in the treatment of chronic bronchitis characterised by a supersecretion from the bronchial membrane, unaccompanied by fever You perceive, then, both the medicines which enter into the composition of persesquinitrate of iron are well calculated to check morbid discharges and strengthen the tone of the system The only objection to this remedy 1s, that it is apt to spoil if kept longer than a week it is decomposed, and hence you should always take care to have it quite fresh when you prescribe it, in order to secure its full operation

I have lately had occasion to observe the good effects resulting from a combination of nitric acid with vegetable astringents, in a little girl three years of age, in whose case I was consulted by Mr Wallace of Townsend-street She was of a strumous habit, her appearance was that of a delicate but not very sickly child, and, in spite of the long continuance of the complaint, she was active and lively, although her appetite was small. Four or five times during the day, and six or seven during the night, she was seized with a slight griping pain, and a sudden desire to evacuate the bowels. Each evacuation was scanty, and consisting of muco-fæcal matter. A great variety of the usual remedies had been tried—alterative doses of mercury, purgatives, astringents, opiates, &c. I prescribed the following mixture, which had the happiest effect, and performed a speedy cure:

R Decocti hæmatoxyli (PD), 3 iv,
Vini rubri Lusitanici, 31,
Acidi nitrici dilut gt x;
Tincturæ opii, gt v,
M sumat cochl 1 medium, quater in die

You will recollect, gentlemen, that nitric acid, when given in large doses, often produces diarrhoea, as in the common combination of one drachm of dilute acid with a pint of decoction of sarsaparilla

A man in the Fever Ward, who has had fever in a very severe form, has latterly presented a tendency to have the circulation deranged in a very peculiar manner in certain parts of his body Soon after his admission the tip of the nose became of a bluishblack colour, and within the last two days his toes began to assume a similar hue This is a very curious symptom, and Here we find a small portion of demands a few observations the skin of the nose becomes injected, the blood stagnates in the capillaries, the parts assume a blue colour, and a kind of morbid desiccation takes place in the cuticle and a thin layer of the skin is thrown off, which is succeeded by the rapid formation of fresh cutaneous substance In the toes the disease is also superficial. it does not engage the whole depth of the skin, or reach the subcutaneous cellular substance, and it is surrounded by a margin of a vivid red colour at the line of demarcation In both places the parts are tender to the touch, but there is no swelling is therefore a superficial disease, not likely to be followed by the death of the parts affected, and differing in this respect from that form of gangrene in old persons which commences with a somewhat similar discolouration of the skin

Now, whence arose the blueness in this case? It is difficult to give a satisfactory answer to this question, but we may arrive at something like a solution by examining the circumstances under which the superficial parts of the body undergo similar changes of colour. If you tie a thread round the first joint of the finger, you will observe that very soon after the circulation has been impeded, the top of the finger will become blue, and, in the same proportion, painful Here we produce artificially a state of the

top of the finger bearing a very remarkable analogy, so far as pain and change of hue are concerned, to the state of the nose and toes in this patient. Again, we find that without any artificial obstruction the influence of certain physical agents will generate in the vessels of various parts of the body a state of circulation closely resembling that which is the result of the impediment produced by art. Thus, sharp cold, as you all know, will produce blueness and a painful state of the integuments of the nose, fingers, and other parts of the body I remember a very curious case of this kind which continued for a very considerable time; the patient was for several weeks in the Meath Hospital He was a groom or helper in a livery stable, and being obliged to have his hands almost constantly in cold water at an inclement season of the year, the capillaries of the tips of the fingers in both his hands became so deranged in their condition, that they did not recover their proper degree of vitality and tone for many months When he permitted his hands to hang for any length of time, or when they were exposed to the ordinary winter temperature of the air, the pain and blueness increased to a considerable degree, but if he held them up or plunged them into tepid water, the pain ceased, and the blueness became much diminished, or even went away altogether

These considerations will furnish a key towards understanding the cause of the blueness in this case. With respect to the treatment, I may observe, that in such cases we have seen the best effects from artificially (p. 515) depleting that portion of the vascular system in which the local congestion and pain are seated. If a ligature were tied round your finger, and you wished to relieve the pain and reduce the congestion, without removing the artificial cause of the obstruction, you would apply leeches to the part, and thus give relief. It was on this principle that I was induced to apply leeches to those parts in which a change of colour and an impairment of sensibility appeared to be connected with some obstruction in the capillary system. You will recollect that this man's toes were better after being leeched, and so far the practice appears to be borne out by the result of experience. You should not in such cases be led away by the theory of our ancestors, who referred this condition of parts to

vascular debility A vast deal has been said and written with respect to the state of the capillaries in disease, some say, that to restore the healthy action of a part we must debilitate, others, that we must excite the capillaries. This point has engaged the talents of Dr. Thomson, Dr. W. Philip, and several other writers, but it still remains undecided, nor do I think it can ever be settled. For my own part, I am satisfied with being able to discover the means of relieving disease, and give myself very little trouble about theoretical questions, which seem, under existing circumstances, to be placed beyond the reach of human intellect. In the case before us, the modes which were most successfully employed were leeches, emollient poultices, and fomenting the parts with tepid water.

We do not often witness this blueness of the integuments in the fevers of Dublin, during the epidemic of 1827, however, it was a matter of frequent occurrence. That epidemic was also very remarkable in many other points of view, it was, if I may so express myself, a bad gastro-typhus It was a fever in which the chief seats of congestion and disease were the stomach and small intestine, at the commencement the re-action of the system was exceedingly violent, but this subsided very quickly, and was followed by a stage of awful prostration The chief interest, however, attached to it, arose from the circumstance of its forming a very striking link of connexion between the ordinary gastric fever of Ireland and the yellow fever of warm countries The phenomena which characterised this epidemic convinced me and every one who witnessed it, that the common gastrotyphus of this country, and the yellow fever of America, Gibraltar, and other places, differ only in degree, and not in nature The disease set in with all the usual symptoms, violent heat of skin, a quick small pulse, sweating, restlessness, thirst, nausea, and abdominal tenderness, this state of things went on for two or three days, and then the patients became suddenly and universally jaundiced The symptoms now began to assume a greater degree of malignity, vomiting came on, a large quantity of dark-coloured substance, resembling coffee grounds, was thrown up, and the case most commonly had a fatal termination. Here, gentlemen, you perceive we had yellow fever with black

vomit I examined the bodies of about twenty-five persons who died in this hospital, and found that the intestinal canal presented an exact fac-simile of the morbid appearances described by Jackson, Bancroft, and various other writers on yellow fever.

In that fever I had frequent opportunities of observing the change in the capillaries of the part, which accompanied the appearance of blueness of the nose To a person who saw the patient with his nose of the natural hue this morning, and found it quite blue on the next, the change appeared strange and unaccountable, but as I spent a great portion of my time in the wards, I had an opportunity of marking the transition, and detecting the modifications which preceded blueness The part about to become blue became altered in a very singular manner. It first became elevated in its temperature, but at the same time it grew paler. I cannot explain this Increased heat would seem to prove the existence of increased vascularity, fading of colour would seem to prove decrease of vascularity Notwithstanding this, these apparently incompatible states co-existed, the parts were blanched, and at the same time felt hot to the touch Where the nose was about to become blue, it first assumed a yellowish white colour, and looked very like a wax nose, in the course of six or eight hours this appearance subsided and it became red, and after a short time this colour was replaced by a purple or dark blue tinge The same order of phenomena took place with respect to the toes, and in a few cases the disease appeared in the fingers Such cases were ordinarily accompanied by so bad a state of febrile symptoms, that the patients seldom recovered, indeed they died so soon after its supervention, that we had no opportunities of observing what course it would take, or how it would terminate The appearance which patients labouring under this affection exhibited, was very extraordinary; they were all deeply jaundiced, and the deep yellow of the face made a singularly hideous contrast with the indigo blue of the nose *

^{*}The remarkable epidemic fever of 1827 was described in a monograph printed by me and Dr Stokes for the use of the students of the Meath Hospital

With respect to the vomiting a substance resembling coffee grounds, so frequently observed in this epidemic, I may state that it appeared to be identical in its nature with the black vomit of yellow fever. You are aware that the matter rejected under such circumstances is produced by an oozing of blood from the surface of the stomach and duodenum. A quantity of blood is poured out from the diseased surface of the mucous membrane of (p. 516) the stomach, this remains in the stomach for some time and coagulates, the secretions of that organ act on it, and change it to a black colour, in which state it is thrown up. This is the case in yellow fever, and such also was the origin of the black vomit in the fever of 1827

I may observe that in that epidemic, as well as in the present, a close inquiry into the history of numerous cases has convinced me that the gastro-typhus of this country, as well as the yellow fever of warmer latitudes, may arise spontaneously, and be propagated by contagion This, I believe, is a fact which every physician who has seen much of fever has not the slightest doubt of. We have all repeatedly seen instances of persons catching cold while the system was in a relaxed or debilitated state, we have seen this cold followed by violent feverish symptoms, and we have observed these symptoms pass gradually into fever of a typhus character, and capable of being propagated by contagion So many examples of this have now occurred, that there can be no doubt that fever may arise spontaneously, that it may become in this way sporadic, and, finally, epidemic At certain periods it appears to be a matter of very little consequence, with regard to the mass of society in general, how many sporadic cases of this description may occur, but at other periods, and under a certain state of atmosphere, the disease becomes extensively diffused, and assumes the character of an epidemic Here each individual case proves a centre of contagion, from which the disease spreads on every side On the other hand, fever may originate spontaneously, assume a typhoid character, and yet produce no contagion Recollecting these circumstances, you will be able to reconcile the conflicting opinions of those who have argued so hotly

respecting the nature of yellow fever, some asserting that it is always contagious, others never. The fact is, that both are right and both wrong, fever may originate spontaneously and without contagion, but it may also be produced by contagion, and it may, under one class of circumstances, run through its course without being communicated to others, whereas under a different state of things each case becomes a centre from which the disease spreads on every side. In the present epidemic of maculated or spotted fever, the contagious nature of the disease was strongly exemplified, for more than twenty of the students who were in the habit of visiting the fever wards in the Meath Hospital were attacked with spotted fever in the course of two months. Although the disease was very violent in many, and serious in all, Dr. Stokes and I lost but one of these students, we had every reason, therefore, to congratulate ourselves on the success of the treatment we employed. I shall return to this subject hereafter.

I have lately seen three cases of violent and long continued palpitations in females, in each of which the same peculiarity presented itself, viz enlargement of the thyroid gland, the size of this gland, at all times considerably greater than natural, was subject to remarkable variations in every one of these patients. When the palpitations were violent the gland used notably to swell and become distended, having all the appearance of being increased in size in consequence of an interstitial and sudden effusion of fluid into its substance. The swelling immediately began to subside as the violence of the paroxysm of palpitation decreased, and during the intervals the size of the gland remained stationary Its increase of size and the variations to which it was liable had attracted forcibly the attention both of the patients and of their friends There was not the slightest evidence of any thing like inflammation of the gland One of these ladies, residing in the neighbourhood of Black Rock, was seen by Dr Harvey and Dr William Stokes, another of them, the wife of a clergyman in the county of Wicklow, was seen by Dr Marsh, and the third lives in Graftonstreet The palpita-Dr Marsh, and the third lives in Graftonstreet The palpitations have in all lasted considerably more than a year, and with such violence as to be at times exceedingly distressing, and yet

there seems no certain grounds for concluding that organic disease of the heart exists In one the beating of the heart could be heard during the paroxysm at some distance from the bed, a phenomenon I had never before witnessed, and which strongly excited my attention and curiosity. She herself, her friends, and Dr. Harvey all testified the frequency of this occurrence, and said that the sound was at times much louder than when I examined the patient, and yet I could distinctly hear the heart beating when my ear was distant at least four feet from her chest! It was the first or dull sound which was thus audible This fact is well worthy of notice, and when duly considered appears to favour the explanation lately given by Magendie of the causes of the sounds produced during the heart's action, for none of those previously proposed seem to me capable of accounting for a sound so loud and so distinct But to return to our subject. The sudden manner in which the thyroid in the above three females used to increase and again diminish in size, and the connexion of this with the state of the heart's action, are circumstances which may be considered as indicating that the thyroid is slightly analogous in structure to the tissues properly called erectile It is well known that no part of the body is so subject to increase in size as the thyroid gland, and not unfrequently this increase has been observed to be remarkably rapid, constituting the different varieties of bronchocele or goitre The enlargement of the thyroid, of which I am now speaking, seems to be essentially different from goitre in not attaining a size at all equal to that observed in the latter disease Indeed this enlargement deserves rather the name of hypertrophy, and is at once distinguishable from bronchocele by its becoming stationary (p 517), just at that period of its development when the growth of the latter usually begins to be accelerated fact, although the tumour is very observable when the attention is directed to it, yet it never amounts to actual deformity The well known connexion which exists between the uterine functions of the female and the development of the thyroid observed at puberty, renders this affection worthy of attention, particularly when we find it is so closely related by sympathy to

those palpitations of the heart which are of so frequent occurrence in hysterical and nervous females

Another fact, well worthy of notice, is that females liable to attacks of palpitations almost invariably complain of a sense of fulness, referred to the throat, and exactly corresponding to the situation of the thyroid This sensation only continues while the paroxysm of palpitation lasts, and frequently is so urgent as forcibly to attract the patient's notice, who now complains of its inducing a sense of suffocation Here the interesting question occurs whether this feeling of something that impedes the respiration at the bottom of the throat, during the hysterical fit, and which has been included under the general term globus hystericus, —the question arises, I say, whether this feeling is always of purely nervous origin. To me it appears probable that it is often induced by the pressure arising from a sudden enlargement of the thyroid, which enlargement subsides as soon as the fit is over Of this I am certain, that the lump in the throat, of which such females complain, is often exactly referred to the situation of the thyroid, and indeed I have been told by other practitioners, upon the accuracy of whose observations I can rely, that this swelling in the throat of females during the hysteric paroxysm has more than once excited their wonder It is obvious, gentlemen, that if palpitations depending on functional disease of the heart are capable of exciting this swollen state of the thyroid, we may expect to observe the tumefaction of this gland also where the palpitation depends on organic disease of the heart, as in the following case detailed to me by a friend

A lady, aged twenty, became affected with some symptoms which were supposed to be hysterical. This occurred more than two years ago, her health previously had been good. After she had been in this nervous state about three months, it was observed that her pulse had become singularly rapid. This rapidity existed without any apparent cause, and was constant, the pulse being never under 120, and often much higher. She next complained of weakness on exertion, and began to look pale and thin. Thus she continued for a year, but during this time she manifestly lost ground on the whole, the rapidity of the heart's action having

never ceased It was now observed that the eyes assumed a singular appearance, for the eyeballs were apparently enlarged, so that when she slept or tried to shut her eyes, the lids were incapable of closing When the eyes were open, the white sclerotic could be seen, to a breadth of several lines, all round the In a few months, the action of the heart continuing with unceasing violence, a tumour, of a horse-shoe shape, appeared on the front of the throat and exactly in the situation of the thyroid gland. This was at first soft but soon attained a greater hardness though still elastic From the time it was first observed, it has increased little, if at all, in size, and is now about thrice the natural bulk of the fully developed gland in a female after the age of puberty It is somewhat larger on the right side than on the left A circumstance well worthy of notice has been observed in this young lady's case, and which may serve to throw some light on the nature of this thyroid tumefaction The circumstance I allude to is, that from an early period of the disease a remarkable disproportion was found to exist between the beats of the radial and of the carotid arteries, the pulsations of the former being comparatively feeble, while those of the latter were violent, causing a most evident throbbing of the neck, and accompanied by a loud rustling sound. In about fourteen months the heart presented all the signs of Laennec's passive aneurism, the tumour in the neck is subject to remarkable variations in size, sometimes diminishing nearly one half None of her family have had goitres, nor was she ever in any of the usual localities of the disease

Some time ago, you will recollect, we had a case of erysipelas in a young woman, which came on towards the termination of fever; a similar occurrence has taken place in a patient in the male fever ward. A man who has been for some time labouring under fever, got about two days since an attack of erysipelas of the scalp, spreading downwards over the neck and shoulders. The man had been ill of fever of a nervous type, and unaccompanied by any decided marks of visceral congestion, his condition was to a certain extent modified by previous habits of intemperance, but still his strength was not much prostrated, nor did

he appear to be in a very dangerous state. About the fourth week of his illness he gets an attack of erysipelas of the scalp, which runs downwards over the neck and shoulders, and threatens very dangerous if not fatal consequences. How were we to treat this case? The man's constitution, habits, and the period of his fever, contraindicated depletion in any form, and the only thing which we could expect benefit from, was the use of sulphate of quinine, which we had prescribed in two former cases of this kind with good effects We gave it here also in the form of an enema, for the state of the man's stomach was such as to preclude the possibility of giving it by the mouth without hazard enema, composed of (p 518) five grains of quinine, five drops of laudanum, and two or three ounces of mucilage of starch, was injected three times a-day I cannot as yet state what the result of this case may be, but the disease is certainly not progressing, and the man says he feels better to-day, so that there are grounds to hope for a favourable termination

Internally I have given this man magnesia with camphor mixture, on an empirical principle. It has been stated by some of the older writers, that when erysipelas occurs in a weak habit, or supervenes on other diseases, that there is an acescent condition of the stomach, and that it is on this condition the erysipelatous tendency chiefly depends. I have with this view been induced to try the exhibition of small doses of magnesia, I have ordered a mixture composed of six ounces of camphor mixture with a drachm of magnesia, of which the patient is to take an ounce every second hour

I may take this opportunity of observing that, since I published some remarks in the *Dublin Medical Journal*, upon the occasional symmetrical march of erysipelas at both sides of the median line, I have seen other examples of this symmetry. One occurred very lately in Sir P Dun's Hospital, in a woman in whom the point of departure for the disease was the face. From this, the erysipelas spread over the scalp, and then advanced downwards over the neck and shoulders. During its daily progress, I pointed out to the students how precisely its outline at one side of the median line corresponded with that at

the other This coincidence was the more singular, for the boundary of the advancing erysipelas was at each side very irregular in form. I think, therefore, that more accurate observations on this subject will cause a change of opinion in the mind of a learned reviewer in Johnson's *Medico-Chirurgical Review*

There is another case, in which I gave magnesia to a man labouring under a particular species of indigestion He had been for a long time suffering from chronic rheumatism, and this was combined with dyspepsia, characterised by a tendency to supersecretion of acid in the stomach, with gastrodynia and sour eructations In addition to anti-rheumatic medicines, enemata to keep the bowels open, we prescribed the subnitrate of bismuth with magnesia, for the purpose of relieving pain and In gastrodynia, with increased secretion of acid from the stomach, one of the best remedies we possess is the subnitrate of bismuth, with which I am in the habit of combining morphia, or, as in the present case, magnesia I ordered ten grains of magnesia, twenty of powdered gum Arabic, and six of the subnitrate of bismuth, to be taken two or three times a-day, according to circumstances: this powder was to be followed by a tablespoonful of water containing one-sixteenth of a grain of muriate of morphia In such cases, if milk does not disagree with the patient, you may pour the powder into a quantity of boiled milk, allow it to cool, and then stir it with a spoon, and make the patient swallow it The gum Arabic is used for its demulcent properties, and because it enables the patient to swallow the powder with more facility, and the fluid in which you mixed the powder, whether it be water or milk, is to be used warm in order to dissolve the gum more speedily. This is a very good combination, and I have seen many cases of dyspepsia, with acid eructations, which had resisted bismuth, prussic acid, or morphia, given singly, yield to it

I need not state to you the reasons why magnesia and other antacid remedies are given in such cases, but it may be necessary to mention briefly the principle on which opiates are prescribed. Dr. Elliotson has shewn, that many of the morbid states of the stomach depend on deranged nervous energy, and that, in such

cases, the most efficient means we can use are narcotics. As to the subnitrate of bismuth, its mode of action is not very obvious, but we know that the metallic salts possess great influence over various nervous diseases, as well as over morbid secretions Witness the effects of carbonate of iron, oxide of zinc, the preparations of arsenic and antimony, and several others On this account we prescribed the subnitiate, hoping to derive some benefit from its use, as well with respect to checking the sour eructations, as to relieving the gastrodynia It may be well to make a few observations in explanation of the manner in which tonics and narcotics act in diseases of the stomach physiologists were of opinion, that in weakly stomachs the act of digestion was accompanied by the formation of acid and flatulence, because the food being imperfectly acted on was allowed to undergo the process of fermentation, a process which gave rise to the acid and the wind in the stomach with this view, physicians endeavoured to procure relief in these cases by prescribing a regimen little likely to undergo a fermentation capable of causing a production of either air or acid, and they endeavoured to neutralise the bad effects of these, when produced, by means of the administration of alkaline medicines They used, however, to be astonished at observing that many articles of food, which outside the body never formed any acid during fermentation (or more properly putrefaction), occasioned, nevertheless, when eaten, as much acidity in the stomach as any other aliments

It was remarked also by practical men, that although present relief was obtained by means of alkalies, yet their constant exhibition seemed rather to increase than diminish the tendency of the formation of acid in the stomach. This fact could not be explained in the then state of physiology. In the year 1821, I read an essay on this subject before the Association of the King and Queen's College of Physicians, in whose transactions it was subsequently published. In this essay I pointed out the true (p 519) source of the acidity and flatulence observed in dyspepsia, and proved, contrary to the received opinions, that it was the result of a morbid secretion. In fact, I showed that the stomach

has the power, when in health, of secreting acids and air, both essentially necessary for the solution of the alimentary mass, and I proved that in dyspepsia this power is morbidly deranged, in such a manner as to give rise to a supersecretion of acids and air. This view of the subject was soon recognised to be correct, and, in consequence, new methods of treating dyspepsia were proposed. Among the proposals for obviating acidity, that of Dr Elliotson, who recommended Prussic acids and other narcotics capable of acting upon the nerves of the stomach (through the influence of which secretion is effected), was found to be the most successful, and has been sanctioned by the most extensive experience

Before I conclude, I shall call your attention to the case of Ellen Farrow, who has been for a considerable time labouring under extensively diffused psoriasis She was admitted about the beginning of last November, and we are now come to the 10th of December, so that she has been a patient here for nearly six weeks Her disease is of better than two years' standing, and the eruption covered almost every part of the surface of the upper and lower extremities, the trunk remaining unaffected The patient, you perceive, is a fine healthy country girl, and though the complaint has lasted so long, her system does not seem to be in the slightest degree impaired, appetite, digestion, and sleep are perfectly good Now, on examining her soon after her admission, you will recollect that I told you that the duration of the disease, the absence of constitutional irritation, and of irritation in the parts affected by psoriasis, all contraindicated a mode of treatment which frequently proves highly useful, namely, the antiphlogistic If called to a case in which the disease was recent, and attended with heat of skin, redness and itching, I would bleed, leech the affected parts, and put the patient on a spare diet Even in some cases of a chronic character, this treatment may be employed with great advantage Here, however, the state of the patient was such as not to require antiphlogistics, and accordingly we put her on the use of Fowler's arsenical solution By the way, when you give this remedy in private practice, where patients or their friends are very curious

in scanning your prescription, you may, in order to prevent alarm, or have the action of the medicine interfered with, write on your prescription—"Liquor mineralis Fowleri"

I mention this case of Farren's chiefly for the purpose of showing the extent to which the arsenical solution may be carried Mind, gentlemen, I do not mean to boast of the quantities of medicine my patients swallow. Some persons appear to think that there is something very brilliant in prescribing enormous doses. I should, however, be very sorry to make such experi-Arsenic is a very powerful remedy, and its effect on diseases of the skin can be amply secured by moderate doses, where these fail, it is very often from not continuing the use of the remedy for a sufficient length of time. Latterly this girl has been taking ten drops of Fowler's solution three times a-day, and, as she is getting well, I do not intend to increase the dose. We began with three drops three times a-day, after a few days this was increased to five, and then to seven drops three times days. daily. She then began to take ten drops three times a-day, but after a few days having got an attack of shivering, followed by symptoms of feverish excitement and herpes labialis, we stopped symptoms of leverish excitement and herpes labialis, we stopped the arsenic for five days, and then began to give it again in small doses, which were gradually increased until we came to the quantity she is taking at present. Whenever you have a patient under the use of arsenic, you must never omit making daily inquiries as to the state of the head and stomach: if the patient complains of gastrodynia or nausea, if there be pain or giddiness of head, or if, these being absent, a state of feverishness or general nervous excitement supervene, it is a proof that the remedy has been pushed sufficiently far, and under such circumstances you should suspend or give up its employment. In this case, being unwilling to give up the use of arsenic, as it appeared to be curing the patient, I merely suspended it for a few days, and then had recourse to it again. In order, however, to prevent it from acting unfavourably on the stomach, I have latterly prescribed it in the following form -

R Liq. arsenicalis, 吸 x; Aquæ distillatæ, 31, Tinct. opii, m x; Spirit. lavandulæ, compos. 3° s.-ft haust. This appears to agree very well with the stomach, and as she is improving very rapidly, I intend to continue it for some time without increasing the dose

The only other point worthy of remark in this case is, that we observed in it a phenomenon connected with the state of the skin, such as usually occurs when a patient is using sulphur or sulphureous waters for the cure of chronic cutaneous affections. After they have been taking these remedies for some time, they experience a slight exacerbation of symptoms, and complain that the eruption is growing worse. This, however, should never induce you to give up the remedy without further trial, for this temporary aggravation generally precedes the disappearance of the disease

We dismissed a case of dysentery lately from our wards, concerning which I promised to make a few observations the months of August and September last, we had in Dublin several cases bearing a decided analogy to the dysentery of Cullen. There were fever, griping, tenesmus, a constant inclination to go to stool without being able to pass anything but a little mucus and blood, and occasionally scybala. In this form of disease, some authors (p 520) are inclined to attribute all the bad symptoms to the presence of these scybala, which are small hard lumps of fæcal matter, evidently formed in the sacculi of the great intestine You will find others asserting that this cannot be the case, for in many dysenteries there are no scybala at all, and that, even when they do occur, they have no connexion with The latter take no account of scybala, while the the disease former state that the diseased condition of the intestine depends upon the irritation produced by them, and that you never can expect to cure the disease without getting rid of them by active purgatives For my part, I believe that there are certain dysenteric states of the great intestine, in which the main cause of the disease arises from the lodgment of quantities of hard, unhealthy, and long retained fæcal matter, but in cases of epidemic dysentery, I do not think that scybala have anything to do with the formation of the disease, or the aggravation of its symptoms

In the present case, the affection appears to have been pure rectile dysentery depending almost exclusively on inflammation of the rectum, not extending to the sigmoid flexure of the colon, and certainly never as far as its arch The symptoms present were fever, increased heat of skin and quickness of pulse, with a feeling of heat and pain in the situation of the rectum, for the first day the discharges consisted of mucus and blood, combined with facal matter, but after this the mucus and blood were voided alone with great griping and tenesmus, and the patient was obliged to get up to the night chair thirty times in the course of twenty-four hours There was, however, no symptom indicating that any portion of the intestine beyond the rectum was affected Now, what was the consequence of this state of things? The inflammation of the rectum gave rise to constant spasm of that organ, the colon partook more or less in its spasmodic action, and hence every attempt to pass the stools was resisted. Here, however, the fieces lay in a portion of the intestine free from inflammation, they could not produce any aggravation of the symptoms, and the scybala were to be looked on as the consequence and not the cause of the disease Now, whether purgatives were given by injection or by the mouth, they would have done no good in such a case as this, we might have copious facal discharges, but without the slightest diminution of the local symptoms. I do not mean to say that there are not dysenteries in which purgatives are highly useful, but in the case before us, where the disease was limited to the rectum, I did not think that any benefit could be derived from them. I confined my attention, therefore, entirely to local means directed to the part inflamed, applied leeches to the anus, gave narcotic and emollient enemata, and after I had in this way relieved pain and irritation, I combined with the enemata, first, a small quantity of the acetate of lead, with the view of restoring the tone of the relaxed mucous membrane, and afterwards changed it for the sulphate of zinc Under this treatment the case went on very favourably, and we have been able to dismiss the man in a very short space of time

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Compiled by

EMERSON CROSBY KELLY, M.D., F A C.S of the department of surgery, albany medical college

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John Fothergill

BIOGRAPHY

- Born March 8, at Carr End, Wensleydale, Yorkshire, 1712 England, one of many children of John Fothergill, a Ouaker and a veoman Attended school in his native town
- 1727 Age 15. After his school education was finished, he was placed with Benjamin Bartlett, an eminent apothecary at Bradford, in Yorkshire
- 1732 Age 20 Went to Edinburgh to study medicine under Professors Alexander Monro primus, Alston, Rutherford, Sinclair and Plummer
- 1736 Age 24 Was graduated from Edinburgh with the M.D. degree, using for the title of his thesis, On the use of emetics
- Age 25 Moved to London and entered St. Thomas' 1737 Hospital
- Age 26 Made a tour of the continent 1738
- 1740
- Age 28 Began practice in London Age 34. Admitted a licentiate of the Royal College of 1746 Physicians
- Age 36. Wrote classic description of diphtheria pharyn-1748 gitis. An account of the sore throat attended with ulcers.
- Age 39 Aided in founding The Pennsylvania Hospital. 1751
- Age 42. Chosen a Fellow of the Royal College of Physi-1754 cians at Edinburgh.
- 1762 Age 50 Because of his interest in the Quaker colony in Pennsylvania, Dr Fothergill presented eighteen anatomical views and three cases of models to the Pennsyl-

vania Hospital Bought a large estate at Upton, near Stratford and developed a large botanic garden, gathering plants from every corner of the globe

1763 Age 51 Elected a Fellow of the Royal Society of London

1765 Age 53 Being a warm friend of the American colonies, he advised repeal of the Stamp Act of 1765

1773 Age 61 Wrote original description of facial neuralgia (tic douloureaux) Of a painful affection of the face

1774 Age 62 Collaborated with Benjamin Franklin in a plan for reconciliation of the American colonies with England

1776 Age 64 Chosen a Fellow of the Royal Society of Medicine at Paris

1780 Age 68 Died December 26 of "suppression of the urine" and was buried on January 5, 1781 in Winchmore-Hill, about seven miles from London

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Dr Fothergill and his friends, chapters in eighteenth century life By R. H Fox. London, Macmillan and Co, 1919 22½ cm, xxiv, 434 pp

Portrait, reproduction of Fothergill drawings; note by E B Krumbhaar. Ann M. Hist, 4: 276-286, 1922

INTRODUCTION

John Fothergill is famous today because he left original and classic descriptions of diphtheritic sore throat and tic douloureaux. In his own day of the middle eighteenth century he was famous because he was one of London's most successful practitioners. He was a keen medical observer and recognized and recorded many unusual medical conditions. In addition, he was noted for his generous philanthropies. He also found time to make an extensive collection of botanic specimens, shells and insects; this later became the property of his old friend, William Hunter

Fothergill's contribution to the knowledge of diphtheria is in the form of a book of seventy-two pages, published in London in 1748. In the twenty-nine years after its appearance the book went through six London editions, it must have been popular and held in high esteem. The original edition is here reproduced in its entirety.

Diphtheria was probably first described by Aretaeus of Cappadocia in the second century. He described ulcers of the tonsils covered with a foul membrane and recorded the high mortality rate when the affection spreads to the throat. The seventeenth century Spaniards wrote several good descriptions of this disease. In Spain the condition was called "morbus suffocans" or "garotillo" because its fatal outcome was similar to the Spanish mode of execution by strangling. Cortesius described an epidemic of diphtheria in Italy in 1620 and recognized the contagiousness of the disease. But no other contribution of note appeared until Fothergill's book of 1748. This author shows that he was well acquainted with the ancient writings because he quotes freely from them. He also had a first hand knowledge of the disease and records the signs and symptoms correctly.

It remained however for Bretonneau of Tours in 1826 to clearly differentiate the disease from all others and to coin the term diphtheria. Another fifty-seven years had to pass until Klebs, in 1883, recognized the specific bacilli of the disease. A year later Loeffler was able to cultivate the organism which is now known as the diphtheria or Klebs-Loeffler bacillus. In 1890 von Behring discovered a specific serum against diphtheria, a work which won for him the first Nobel Prize in 1901. In 1913 Schick described his skin-reaction test to show susceptibility or immunity

to diphtheria and in 1923 Ramon introduced the antitoxin which is a modified and safe method of producing immunity

We have come a long way from John Fothergill, but he helped show the way

Fothergill's description of facial tic or tic douloureaux is in the style of many of his contributions to medical knowledge. The essay covers only thirteen small pages and does not attempt to exhaust the subject, it records only the author's personal experience with the condition. Nevertheless the work is an important landmark in our knowledge of the disease and is herein reproduced in its entirety.

John Fothergill, being a Quaker himself (and a philanthropist), was interested in the Quaker Colony in Pennsylvania. He was helpful in founding the Pennsylvania Hospital in Philadelphia in 1751 where still may be seen the anatomic drawings and models which he donated. He wrote against the oppression of the American Colonies by Britain, advised repeal of the Stamp Act of 1765 and aided Benjamin Franklin in drawing up a plan of reconciliation with the Mother-country in 1774. Fothergill's friend and biographer, John Coakley Lettsom, was also a close friend of the American Colonies.

Thus in this number of MEDICAL CLASSICS we have important papers on diphtheria and facial tic by a famous London practitioner and an influential internationalist of the eighteenth century



An Account of the Sore Throat Attended with Ulcers

A Disease Which Hath of Late Years Appeared in This City, and the Parts Adjacent

 $\mathbf{B}\mathbf{Y}$

JOHN FOTHERGILL, M D

London Printed for C Davis, over-against Gray's Inn Gate, Holborn

MDCCXLVIII

PREFACE

SIMPLE inflammation of the tonsils, or of other parts about the fauces, from its frequently happening without any considerable hazard attending it, is commonly looked upon as a troublesome, rather than a dangerous disease. And every one, how little soever conversant in the practice of physic, thinks himself qualified to conduct the patient thro' it with safety

If a person complains of pain in his throat upon swallowing, with the symptoms of a fever, nothing is thought more expedient, or more frequently ordered, than bleeding, purging, and such medicines as are daily observed to remove inflammations in general And in simple inflammations this method is warranted to by just, by reason and experience

But a disease hath of late years appeard in this city, in many of the neighbouring villages, and according to the best information (p 11) I have been able to procure, in several other parts of this nation, which, tho' it may be taken for a common sore

throat, or a simple inflammation of the tonsils, by those who are unacquainted with it, is of a very different nature from the common one, and requires to be treated in as different a method. For it has been found by experience, that those measures, which seldom fail of answering the prescriber's expectation in this case, frequently produce the most unhappy consequences in the other, and render a disease almost certainly fatal, which of itself is not often so, in this country

Some instances of mistakes in this respect have not long since fallen under my observation, and there is still a possibility of the like happening, as the same disorder continues amongst us. It seems therefore necessary, that some endeavours should be used to prevent them, and that such a description of the disease should be made public, as might enable practitioners, who have not seen or known it, to distinguish it from that to which it bears some resemblance, together with an account of the method of treating it, which hath in general been attended with success

There are several of the faculty, who, I readily acknowledge, have it more in their (p. 111) power to give the public satisfaction on this subject, than I have, but their constant engagements in the duties of their profession, will probably hinder those who are most equal to the task, from executing it so speedily as public utility requires: Wherefore, as some information relative to it seems immediately wanted in several places, the following, tho' less perfect, will perhaps in the mean time be neither unacceptable, nor wholly useless

If any thing in these sheets should appear, to those who may be better acquainted with the subject, to be inaccurate, or premature, if some things of little weight should seem too largely insisted on, whilst others of more consequence are neglected, this apology will, I hope, be admitted, vis that to have delayed the publication of this essay, till it had received those advantages that further observations might have added, would have frustrated my design, which was, to prevent, as much as possible, the mistakes that might happen in relation to this disease, by speedily communicating the remarks, which the instances I had seen had afforded

As this disease appears to be the same with that which raged in Spain, Italy, and the neighbouring countries, somewhat more (p iv) than a century ago, it may not be improper, in the first place, to give some account of it, from such of the authors who then wrote upon it, as have come to my hands, previous to a description of the same distemper, as it now appears in this country

'Tis said, that a similar, if not the same disease hath long been in some of our American Colonies, and the West-India Islands, but as I have met with no accounts of it from such as were competent judges, it must be left to time, and further inquiries, to determine the truth or falsity of the report

London, Dec 1

OF THE SORE THROAT ATTENDED WITH ULCERS

As it Appeared in Spain, Italy, Sicily, &c

The disease which is called by the Spaniards Garrotillo, by the Italians, and other nations, Morbus strangulatorius, Pestilens Faucium Affectus, Epidemica Gutturis Lues, and by divers other appellations, is said to have appeared (p 2) first in Spain about the year 1610, to have spread from thence to Malta, Sicily, Otranto, Apulia, Calabria, and the Campagnia, in the space of a few years, and to have broke out at Naples in 1618, where it continued upwards of 20 years ravaging the different parts of the kingdom^e

It is not certainly known how much longer it remained in these countries, or to what others it was communicated at that time, its declension being as obscure as the causes it sprung from.

^a Ab Hispanis Garrotillo appellatur, ut eadem patiantur Angina laborantes, quae facinorosi homines, cum injecto circa collum fune strangulantur Epist R Moreau ad Th Barth Epist Med Cent i p 336

b Affectus suffocatorius, Carbunculus angionosus, Phlegmone anginosa, Angina pestilentialis, Epidemica Gutturis Lues, Morbus Gulae, Morbus Puerorum, Pestilens ac praefocans pueros abscessus, Tonsillae pestilentes, 'Ανχόνη λοιμώδκε, Aphthae malignae Passio anginosa, Laqueus Gutturis, &c Vide Cortes Miscel Med p 696 Severin & Epist Ren Moreau ad Th Barthol de Laryngotomia

e Severin de recondita Abscessuum natur p 446

That it wholly disappeared in these parts, soon after the time above-mentioned, seems probable, from the silence of those physicians, who have published their observations made in the places, which had so severely felt the effects of this distemper

Several writers, as Wierus^a, Forrestus^e, Ramazzini^f, and others, take notice of epidemic affections of the throat, in some respects resembling the disease here described, but a little attention to the symptoms of each, (p. 3) will, I think, discover an essential difference between them The same I think may be said of the sore throat and scarlet fever, which shewed itself at Edinburgh in 1733^g

Tournefort, in his Voyage to the Levanth, seems to have met with this disease in the islands of the archipelago, at least so far as one can judge from the imperfect description we have of it His account is as follows

"When we were in this Island (Milo) there raged a terrible distemper, not uncommon in the Levant. It carry inff children in twice 24 hours. It is a carbuncle or plage-sore ill de bottom of the throat, attended with a violent fever This mala a, which may be called the child's plague, is epidemical, tho' it spares adult people The best way to check the progress of it, is to vomit the child the moment he is perceived to grow heavy-headed. This remedy must be repeated, according as there is occasion, in order to evacuate a sort of Aqua fortis, that discharges itself on the throat It is necessary to support the circulation of the juices, and the (p 4) strength of the patient, with spirituous things such as the Theriaca, Spri vol oleos aromat and the like The solution of Liquid styrax in brandy is an excellent gargarism upon this occasion Tho' it is a case that requires the greatest dispatch, the Levantines are seldom much in haste in the cure of any disease"

This account does not disagree in general with that which has

d Joh Wieri Observat lib vi de Angina pestilenti Epidemica, Oper p 910

Pet Forrest Observat lib vi de Febribus publice grassantibus, p m 150

Bern Ramazzini Constitutiones Epidem Oper p 195, & seq

Medical essays, vol 111, p 26

h Tournefort's Voyage to the Levant, vol I p 133

been left us of the Morbus strangulatorius, only he is singular in asserting it to arise from a kind of Aqua fortis discharged upon the parts. But his favorite study had engrossed his attention, and to this we must impute both the present mistake, and his want of accuracy and precision too frequently, when he treats upon medical subjects

When it first broke out in the countries above-mentioned, it soon engaged the physicians of those times, as well to observe its nature, effects, and whatever might contribute to its cure, as to vindicate their respective systems and opinions, and out of such of the tracts then published as I have had an opportunity of perusing, the following account of it, as it appeared at that time, has been collected

(p 5) Ludovicus Mercatus, physician to Philip II and III, Kings of Spain, among his consultations, published in Tome V of his Works, has one upon this disease. He mentions it as a calamity which had but newly appeared, and at that time affected several princes and cities of that kingdom. He has related only on secase, but, in commenting upon it, according to the method of writing on diseases then in use, he takes notice of several circumstances relative to it, and makes some observations respecting the cure, which, tho' they seem to have been neglected by many who succeeded him, experience hath since shewn to be just, some of these will be pointed out in their proper places. And, considering that he wrote very soon after the distemper broke out, the approbation prefixed to this part of his work being dated in 1612, they are a proof of his attention and sagacity.

Johannes Andreas Sgambatus, a physician of Naples, published a treatise upon this (p 6) subject in 1620. He gives us a methodical and pretty exact history of the symptoms, and method of

² D Ludovici Mercati, Medici a cubiculo Philippi III Hispaniarum—Regis, &c Oper Tom 5 Francof 1614

b De Faucium et Gutturis anginosis et lethalibus Ulceribus Consultatio xxiv p 137
 i De pestilente faucium affectu Neapoli faeviente, opusculum, auctore Jo Andrea Sgambato, philosopho ac medico Neapolitano, et academico otioso Neapoli excudebat Tarquinius Longus, 1620, in 4to

cure both general and topical, together with a summary view of the disputes, which at that time were managed with sufficient heat and acrimony, in relation to its name, cause, and nature, about which they were as much divided as they were about the method of cure, each party appealing to Hippocrates, Galen, Avicenna, &c for the support of their opinions concerning a disease, which it is not certain that those whom they appeal to ever saw

Johannes Baptista Cortesiu, in his Miscellanea medicak, takes notice of this disease, and describes its principal symptoms, in a letter to Jo Anton Anguilloni, physician in chief to the Maltese Gallies He considers it indeed as a different distemper from that which infested Naples, and other parts of Italy, tho', from his own account of it, there appears little (p 7) reason to question its being the same He seems to have been led into this mistake, by considering the disease he treats of, as contagious only in a certain limited sense, whilst the Italians, as some of the Spaniards had also done, declared theirs to be pestilential and contagious without restriction He allows, that the breath of a person affected might convey the contagious effluvia to another near at hand, and gives an instance of one who got the disease, and died of it, by trying, at his friend's request, who then laboured under this disease, if his breath was affected. for from this circumstance they guessed at the degree of danger attending them

(p 8) In 1636, Aetius Cletus, of Signia in Italy, published his

^k Joannis Baptistae Cortesii, medici ac philosophi, in Messanensi academia praxim ordinariam e prima sede interpretantis, Miscellaneorum Medicinalium Decades Denae Messanae 1625, in fol

¹Divi Francisci Custos, vir doctrina et moribus insignis, hac lue obsessus, tonsillas solummodo et gargareonem inflammatione laesa habebat, et continuo querebatur se percipere in ore faetorem quendam, et ut hac de re certior redderetur, ad se vocavit baccalaurem quendam sibi amicissimum, qui maximo affectu affistebat, rogavitque ut vellet olfacere, percipereque naribus, an verum effet talem faetorem emittere, an ab ejus imaginatione prodiret olfecit baccalaureus me (scil Cortesio) praesente, et multis aliis, at statim non multis elapsis hors decubuit sola faucium et glandularum inflammatione vexatus, absque aliqua manifesta corruptione partium, omnibusque praesidiis ex arte factis, quarto die suffocatus periit, et tamen Custodem non tetigerat, sed solo olfactu aerem ab ore prodeuntem naribus traxerat quare ab hujusmodi exemplo veni in sententiam hunc morbum non esse absque aliqua contagione Cort Miscel p 698

Treatise De morbo strangulatorio^m He mentions some facts relating to it, that had escaped Sgambatus and Cortesius, which will be taken notice of hereafter

Marcus Aurelius Severinus, Professor of Anatomy and Surgery, and Physician to the Hospital of Incurables at Naples, wrote a dissertation upon this disease, under the title of Paedanchone Loimodes, seu de pestilente ac praefocante Pueros Abscessu, and annexed it to the second edition of his book De recondita Abscessuum Natura, which was printed in 1643ⁿ From a person of his capacity, and furnished with the best opportunities of seeing the disease in every stage and condition, we might reasonably have expected such observations as would enable one to form a just idea of this distemper, but we meet with little of this kind in his performance He has indeed mentioned some circumstances relating (p 9) to its history, not taken notice of by the other writers I have seen, and his method of cure is different from the rest, but he refers us to others for an account of the symptoms, and contents himself with reciting and commenting upon Aretaeus's description of the Ulcera Syriaca, which he takes for granted to be the same with the disease which at that time infested Naples

One might justly expect some curious observations upon this disease, from a person so well qualified for it as Thomas Bartholine He was in Italy whilst it raged there, and it might be supposed, would be attentive to the minutest circumstance relating to it, and be inquisitive enough to know what men of character had said upon it But the treatise which he wrote upon this disease, and published in 1646°, contains so little to the purpose, that it is difficult to conceive for what end it was wrote, unless

^m De morbo strangulatorio, opus Aetii Cleti Signini, doctoris medici et philosophi Romae 1636 8vo

n De recondita abscessuum natura, libri 8 Marci Aurelii Severini Tharsiensis, philosophi et medici, regio in gymnasio Neapolitano anatomes et chirurgiae professoris Editio secunda, Francosurti ad Maenum 1643 And again printed with Bartholine's Exercitationes, as a Commentary upon it, with Villani's Therapeuta Neapolitanus, seu veni mecum Consulter Neapoli 1653

^{*} Thomae Bartholini de Angini Puerorum Campaniae Siciliaeque epidemica exercitationes, Lut Parisior 1646

to compliment his Master Severinus, which he does very liaberally b

In his partibus (scil faucibus) ex humoris virulenti affluxu gignuntur carbuncolasae inflammationes, quae pestis dirae, aut veneni promptissimi instar, contagio quodam, pueros et adultos corripiunt, et saevis maleficentissimisque stipatae symptomatis citissimam necem inferre solent Malum in Hispania non multis abhine annis frequens, vulgus medicorum Hispano sermone Garrotillo nuncupat, de cujus essentia, periculo, brevitate, et complicatione ustivi et ulcerosi tumoris, ac deleteria corruptione, Hoc fuit pressus biennis infans, sanguineus et laconice dicam Primo die ex catarrhosa defluxione in suffocationem pene incurrit, difficulter respirabat, et lac deglutiebat, et febri acuta affectus, nec plorare poterat In parte gutturis dextra externa glandulosus apparuit tumor cum dolore multo die intra fauces ulcus visum est ad nigrum vergens, quod putrilago et mollities multa comitabantur, at ab ore factor horribilis prodibat, magnum certe corruptionis completae indicium nullis adjutus auxiliis strangulatus est extinctus De praxi medic admiranda, lib i observ 90

- (p 10) According to the accounts which have been left us by these authors, it appears, that the disease which they describe was extremely malignant, and most particularly fatal to children, tho' adults, if they were much conversant about the sick, were very often seized with it, yet more of these recovered in proportion than of children, and it was observed, that more boys got well through the disease than girls. Some thought, that such of this sex as had black eyes suffered more from it than others
- (p II) As it was sometimes observed to carry off whole families together, and to spread to those places first, between which and the countries affected by it the communication was most frequent, and also that children, sent away from the towns where it raged, in order to avoid it, escaped whilst they were kept at a distance,

^b Zacutus Lusitanus also mentions this disease, and relates an unhappy instance of its effects in the following terms

but had it on their return, if the disease was not extinguished, it was almost universally allowed to be contagious °

Those who were seized with it, first complained of a pain or soreness in the throat, with a stiffness of the neck, an uneasiness on moving it, as if a cord was twisted about it, a difficulty in swallowing, and frequently in breathing also, with a disagreeable fetid smell and taste. On inspection, the uvula, the tonsils, pharynx, and the whole fauces, appeared of a remarkably florid red colour, like that attending an erysipelas. This colour was not uniformly intense, but some parts seemed to be of a deeper dye than others. The parts above-mentioned were swelled more or less, tho' not always so much as to affect respiration, as in a common angina.

- (p 12) If the attack was violent, they had an extreme difficulty in breathing, and also in swallowing, with a kind of compressive pain and straitness of the breast and back, a redness of the whole face and neck, great heat of all the parts affected, depravation of the voice, an unquenchable thirst, and the patient seemingly in danger of being choaked In some, the swelling and ulcers of the fauces were apparent upon looking into the mouth, in others, nothing could be seen, but a most offensive putrid smell was perceivable. A fever came on with the other symptoms, and was frequently accompanied with small pimples and eruptions like flea-bites. In very bad cases, this fever, which Mericatus calls a most malignant one, did not always discover its violence or malignity at first, but it was not the less formidable on this account.
 - (p 13) On the same day, or the day following, such parts of
- ° Quod ad contagium attinet, hoc communi omnium consensu atque experimento evincitur. Severin p 442
- difficultas respirandi, et non raro deglutitiendi, cum pectoris et dorsi dolore ac veluti compressione suffocante, simul cum pestilenti odore, et vehementi harum omnium partium ardore, et rubore totius oris et colli, cum vocis et loquelae vitio, ac linguae extractione, et siti incompescibili Mercat Consult p 136
- Manime ob malignissimam febrem, quam plerumque sibi adjunctam habet, &c Consult p 136
- nec multum, fidere oportet, si febris mox non appareat aut succrescat, nam saepe citius suffocat affectio, quam causa succendatur, ac non raro malignitas humoris corrumpit spiritus et mortem accelerat, sine eo quod febris succendatur Mercat Consult p 137

the fauces as at first seemed to be of a deeper colour than the rest, turned white, ash-coloured, or black, this was not occasioned by any crust or matter superinduced upon the parts, but proceeded from a gangrenous colliquation of them, the substance itself being mortified

The voice was hoarse and obscure, not as in a common cold, but as it is in those people who have venereal ulcers in the throat. So that, from this circumstance alone, some were able to guess at the disease t

The neck and throat soon after began to swell externally, the tumour was of a soft aedematous kind, and increased in magnitude as the disease advanced. All the symptoms were aggravated during the night. If the patients had any interval of quiet, it was commonly in the day-time. About the fourth day this tumour was generally grown very large, and the white places in the fauces began to turn black, a putrid corrosive sames was discharged by the mouth and nostrils, the breath grew extremely offensive, (p. 14) respiration, if hitherto not much affected, now became difficult, and the patient expired in a very short time

Tho' this was the common progress of the disease, where it terminated unhappily, yet it often varied from this type, and was attended with very different symptoms. Some had an extreme difficulty of breathing almost from the first, some had a violent cough, some were comatous, others had a delirium, some died in a lethargic stupor, others bled to death at the nose, whilst others again had none of these symptoms, but were carried off suddenly by an instantaneous suffocation. The oesaphagus in some was sphacelated to the stomach, the Aspera arteria, in others, to the lungs: As these could only breath in an erect position, so those could swallow nothing when the parts were so

Severin p 442

^u Sgambat

W Quibus etima accedit sublimis respiratio et alta ac spirituum revulsio, cum maxima pinnarum nasi distentione,—saniei per os et nares excretio, variis ulcerium coloribus et intensissimo faetore nauseam plerumque movente cum sordida excretione. In aliquibus vero extra, prope cervicem, et infra mentum glandulae apparent, pestiferi morbi naturam redolentes, et universa cervix, et collum intumescunt, et fauces cum rubore saturato, instar laqueo suffocatorum. Merc Consult p 136

affected The nostrils discharged a fetid ichor, sometimes mixed with blood, and sometimes blood alone, without mixture This bleeding at the nose seemed at first, in one case, to give relief, but the patient soon after died * Mercatus (p 15) relates an instance of a child that had the disease, in which the acrimony of the humour discharged from the ulcers was so great as to inflame the nurse's breast, and brought on a mortification. He also tells us, that the father of the child whose case is described above, having frequently put his finger in the child's mouth, to draw out the viscid phlegm, had his finger inflamed, and was seized with the same distemper.

These were the symptoms in general, and they judged of the event by the mildness of their progress, or the contrary Tho' it was agreed, that nothing could be more fallacious than this disease, and that the most experienced were often deceived in their prognostic

If the redness of the fauces above described, which appeared at the first being seized, was succeeded by an ulceration, without any of that whiteness (which for the future I shall call sloughs), if the swelling about the neck and throat was not (p. 16) large, if the patient discharged by the mouth considerable quantities of thin pituitous matter, if the breath was not fetid, and the patient had no disgust to his food, if the eyes retained their proper lustre, all was judged to be secure

On the other hand, if this lustre was in any degree faded, if the external oedematous tumour was very large, if the breath stunk, if the fauces were livid or black, with a coma or delirium, if with these the patient had an aversion to his nourishment, and his breathing became difficult or laborious, the danger was judged to be extreme

^{*} Severin p 440

erat quidem dira humoris conditio adeo perniciosa, efficax et contagiosa, quod digitum patris indicem, quo extrahebat eum succum ob ore filii, mordicaret, et in ruborem moveret cum dolore tandem mox pater conquerebatur de difficultate respirandi et deglutiendi cum dolore et tumore faucium, ac saturato colore, et glandulis extra apparentibus juxta mentum Ex quibus secundo die halitum prave olentem expirabat, ita ut jure optimo possis colligere, contagio filii patrem fuisse affectum Mercat Cons p 139

^{*} Hoc unum salutis est indicium vel interitus dum oculorum nitor adservatur, salutis spes semper adeft, quo tempore hic deperit, in propinquo mors est Aetii Cleti Op

It was not observed that the disease had any stated crisis, or that the signs of recovery, or death, appeared on any certain day. Some died on the first, others on the second, third, and on every day, to the seventh, tho' the greatest part died before the fourth. Those who survived the fourteenth, were thought to be out of danger, at least from the disease itself, though some dropped off (p 17) unexpectedly, after a much longer reprieve.

The consequences of this disease were often felt a long time after it had ceased. An excessive languor and weakness continued for many months, and the voice or deglutition was frequently affected, so as to be perceivable in some almost a year after d

It was however observed, that notwithstanding the disease most frequently was accompanied with symptoms of pestilential malignity, yet it sometimes appeared with a much more favourable aspect; its progress not being so quick, nor its symptoms so violent and dangerous, as hath here been described to be the case in general. At its first breaking out in any place it was commonly the most severe, it then spared no age or sex, but swept off adults together with infants. By degrees it became less violent, and at length either wholly disappeared, or was of so little consequence as to be disregarded.

(p 18) We are directed, by most of the authors I have seen, to begin the cure of this distemper, whenever we are called in time, with evacuations; the chief whereof are bleeding and purging: Which of the two ought to precede was not a little disputed, but it was on all hands agreed, that unless these remedies were very early applied, as they were principally useful by way of revulsion, they were not only of no advantage to the

^{*...} indies magis ac magis haec accidentia crescunt, donec brevissimo tempore laborantium majorem partem perimat idque non raro intra quartum diem. Merc p. 137.

^b Aetn Cleti Op. de Morbo Strangulatorio

[&]quot;Quinimo post xxx dies, et xl Jam praerepti morbi furoribus, praeter omnium opinionem ex improviso sunt extincti. Adeo scil latitans et recondita veneni vis est Severin p 440

d Act Clet.

^a Servin

ut pestis more in citissimam mortem pueros adultos deducat. Merc Consult p 135

patient, but highly injurious ^E An observation of this kind, we are told^h, induced several physicians to omit bleeding intirely, and it was, probably, the reason why those who were friends to venesection directed it more sparingly in this, than in most other (p 19) acute diseases¹ Severinus, who was by no means a timid operator, orders from four to eight ounces to be taken away, which, considering the common practice in those countries, is a very small quantity ¹

Some not only gave the precedence to purging, but imagined it alone was sufficient, alledging, as a reason for it, that some children had recovered, where this evacuation only had been employed, whilst bleeding had been injurious, by lessening the strength k Purging was however commonly allowed the second place, by those who were advocates for bleeding, (p 20) but under the like restrictions 1 They generally made use of manna, rhubarb, senna, tamarinds, syrup of roses, and the like, for this

disputare coepimus de sanguine extrahendo siquidem non defuerunt medici, qui id renuerent caeterum unamimi consulentium consensu, primo die sanguinem misimus, cruribus scarificatis, et mox octava noctis hora brachiis, aut si ultra duos annos suerit natus, ex vena brachii in hoc malo plurimum vereri oportet, vires plurimum dejicere. Mercat

Brevissime secandam esse venam in hoc confitentur omnes P Mich de Heredia de Morb acut p 101

h Circa quod praesidium (venaesectionem) in pueris exequendum, consulo ne differatur, quia ejus occasio solum est, antequam fluxio in partibus contenta ad putredinem commigret. Nam tunc temporis, si sanguinem suderis, summopere laedes, quae causa fuit quod multi medicorum, viso hoc damno renuerint sanguinem mittere. Mercat Consult p. 138

In hoc sacro igne non mittendus est sanguis in ea quantitate ac in angina exquisita—Placuit quibusdam in hoc morbo secare venas sub lingua, alii admoverunt hirudines collo mihi nulla istarum evacuationum unquam probari potuit. Nam cum tumor superveniens ex sanguine non oritur, frustra adhibentur ea auxilia quae ad sanguinem ex parte affecta evacuandum excogitata fuerunt. Sgambat de Pest Faucium Affect

Esse vero efficiendas parcas missiones in quantitate, dum revellere intendimus, docuit antiquitas —Quod praeceptum magis observandum in morbo praesenti, in quo nimis timemus virium jacturam Copiosa enim sanguinis missio, praeterquam quod minus proprie revellit, dejicit vires P M de Heredia, ubi supra

¹ Severin, ubi supra

hoc solo praesidio aliquando visum fuit, pueris ad integram sanitatem recuperandam sufficere, sicut aliis sanguine detracto, vires plurimum fuisse dejectas Merc cons p 138

¹ Quod evacuandum morbus exposcit, evacuetur brevissime Idem, p 102

purpose But it was always inculcated, that, in directing these evacuations, the patient's strength was especially to be regarded, since whatever diminished this, in the end was undoubtedly prejudicial m

Severinus orders an antimonial vomit to be given at the first attack, and a cooling gently astringent gargle to be used night and day. He then directs a clyster, takes away some blood from the jugular, and gives from xv to xxi grains of bezoar mineral twice a day, or oftener, as occasion requires, with thin duluting liquors, in order to raise and promote a moderate sweat. He gives five or six grains of the same medicine to children at the breast, and commends it highly. He scarifies the discoloured parts in the fauces, in order to let out the corrosive virus, a practice, which, though it was recommended by the Spaniardsⁿ, (p 21) was disliked by some of the most eminent Italians o

Cupping, with scarification, was universally approved, and commonly practised Leeches were also applied, by way of revulsion, to different parts

Considerable benefit was expected from ligatures made on the extremities, and from chafing the limbs with the hand, or a cloth, also from cupping without scarification, apprehending that a revulsion from the parts affected was by this means procured, and that some portion of the morbific matter was carried off by the pores of the skin

Some of the Spanish physicians recommended vesicatories of cantharides, and other acrid caustic substances, to be laid on each side the neck, but they had not the same opinion of their usefulness, when applied to the back or shoulders. Heredia expressly tells us, that he had seldom found any benefit from them. Neither do the Italian physicians seem to have been fond of them, the

m in morbis malignis breviter destruentibus vires, et poscentibus simul robur animalis virtutis ad sui sanationem, multum evacuare non licet Heredia, p 102

ⁿ Si vero malum non mitescat, sed gravius affligat partem, quod constabit ex jucido aut nigro colore, vel ex nimia mollitudine—cum intolerabili faetore, scarificabitur profunde, prout partis natura tulerit Heredia, p 105

[°] Cort Miscel p 697

^p Multi etiam vesicatoria consulunt spatulis applicata,—Quod auxilium parum prodesse semper vidi Heredia, p 108

progress of the disease was, in their opinion, too swift to admit of any (p 22) relief from either caustics or vesicatories, both which had been made use of in Spain r

To moderate the continual and maligant fever, which accompanied this disease from the first, and which was thought by some to be only symptomatical, and had therefore the last place in their consideration, they had recourse to such internal medicines as were deemed coridal and alexipharmac Bole, Bezoar both animal and mineral, and according the philosophy of those times, the precious stones, were reckoned of this class Of vegetable products, the juices of citrons, lemons, oranges, pomegranates, and sorrel, vinegar, the juice and decoctions of borage, bugloss, carduus benedictus, endive, scabious, scorzonera, scordium, with many others of the like nature, were But a decoction of the contraverva root was in recommended the highest esteem, both for its great use as an alexipharmac in general in this disease, and its particular efficacy, when applied as a gargle to the throat, of which Mercatus, from his own repeated observations, gives a very ample testimony t

(p 23) But as they found from experience, that no regular crisis or concoction of the humours was to be waited for, that no evacuations, except by way of revulsion, after the access, were of use^u, they began to consider the disease as local, a peculiar morbid affection of the fauces, and applied themselves chiefly to topics, without laying much stress on internals

In this part of their directions they have therefore been more explicit, and some of them, in order to point out their applications with more propriety, have divided the course of this disease into four different periods *

^q Sgambat

r Heredia, ubi supra

Febris etiam continua statim in initio apparet, symptomica quidem Idem, p 97

tHoc unum observantissimum habeo, nimirum omnes oris et gutturis collutiones efficere supra decoctum ejus celeberrimi medicamenti, quod medici Hispani Contrayerva noncupant, maxime si mucosa et viscida pituita abundaverit Mercat Consult p 138

Experimento monstratur, quamcunque evacuationem per alvum, aut sudorem inutilem esse et nocivam, quia cum non profit, necessario debilitat Hered p 100

Cortes Miscel p 703

^{*} Sgambat de Affectu Faucium pestilente

The first they called the state of inflammation In this mild repellents were thought necessary, such as vinegar in barley-water, juice of pomegranate, syrup of roses, mulberries, purslaim, or a decoction of barley, red roses, liquorice, and plantain, to two pounds of which were added Acet. Ros iss Syr (p 24) Diamor 5 i M^y If it was required yet more repellent, a small quantity of alum was added

The second stage is that wherein the white sloughs begin to appear, which is a step towards a gangrenous colliquation. In this they ordered mild abstergents and antiputrescents, such as a decoction of lupins, beans, vetches, with honey of roses *

The third is, when the ulcers appear foul and sordid, and begin to look black, a real mortification being come on, sometimes penetrating to a considerable depth, with great putrefaction More powerful astringents and exsiccants were requisite in this case, such as powder of myrrh, and a little alum mixed with honey, or honey of roses Bole dissolved in treacle-water, a solution of Unguent Aegyptiacum in barley-water was also much in use, alum, sulphur, copperas, verdigrise, oil of vitriol, oil of sulphur, spirit of salt alone, or mixed, or diluted in different liquors, were much employed. In this case, sometimes the acid (p 25) were dextrously applied to the parts affected by means of an armed probe, but they were oftener diluted with syrup or honey of roses, and in children poured into the mouth

Tho' many had recourse to these powerful remedies, and even to arsenic itself, yet the most experienced were justly afraid, that the use of such caustic and acrimonious applications was often attended with pernicious consequences, both to children and adults, and they are therefore, with great reason, condemned by Mercatus b

Heredia, p 105

^{*} Item ibid

^{*}Celebris utilissimaque est unguenti Aegyptiaci lotura sumuntur quidem 3 ij et infunduntur in 5 ij aquae hordei, plantaginis, vel seri lactis post infusionem percolatur per linteum, et colatura tangitur ulcus Idem ibid

^b Ego quidem arbitror, plures pueros interfecisse usum horum medicamentorum, quae caustica sunt, quam affectionem ipsam Merc Consult p 139

compertum habuimus in hoc viro, et aliis laborantibus, haec caustica inflammatione et ulceri summopere esse nocua suppurantia corruptioni. Id p 40

Nevertheless some went so far as to advise the actual cautery, if the potential ones did not succeed, and give directions for the time and manner of their applications, but as this operation will be liable to all the objections made to the former, to have mentioned it will, I imagine be thought sufficient.

Tho' the author last quoted advises us to scarify the black or livid crusts or sloughs, yet he gives us a caution not to tear them off, or forcibly separate them, as the consequences (p 26) would be an increase of pain, and inflammation, whence the ulcers would spread, and at the same time eat deeper d

In the fourth stage the putrefaction is supposed to be extinguished, the mortified parts cast off, and an ulcer only remains In this case, the fume of white amber thrown on live coals, and received into the mouth, as a suffitus, was advised, also the vinum myrrhites, a decoction of guaiacum, roses, balaustines, pomegranate-peels, by way of gargle, medicines that were supposed to dry with some degree of astringency

Such was the appearance of this disease at its first being taken notice of in Europe, and such, as far as I can collect, the methods of cure pursued by the authors above-mentioned

The disease which is described in the following pages, appears to be the same with the Angina maligna, or strangulatory affection of the fauces of these writers, and seems only to differ from that in degree, in which, as it is much more favourable and mild with us in general, than it was in the countries where they practised, we have greatly the advantage

OF THE SORE THROAT ATTENDED WITH ULCERS AS IT HAS APPEARED IN THIS CITY, AND PARTS ADJACENT

According to the information I have received from several eminent persons of the faculty, it was in the year 1739, that a disease was first taken notice of, which was thought to be the Morbus strangulatorious, already described, and which differed in no essential circumstance, as far as I can learn, from the distemper which is the subject of this treatise.

[°] Heredia, p 106

d Idem p 109

The sudden death of two children in a family of distinction, and of some others near the same part of the town, whose complaints had chiefly been of a sore throat, seem to have occasioned this suspicion. But as very few cases of the like nature occurred after these, or, if they happened, passed unobserved, little mention was made of it during several years

(p 28) It began however to shew itself again in 1742, but not in so general a way as to render it the subject of much public discourse; for tho' such of the faculty, as were in the most extensive practice, met with it now-and-then, in the city especially, it remained unknown to the greatest part of practitioners, till within these two or three years, in which time its appearance hath been more frequent, both in town, and the villages adjacent.

In the winter of 1746, so many children died, and so suddenly, at Bromley near Bow in Middlesex, of a disease that seemed to yield to no remedies or applications, that the inhabitants were greatly alarmed by it; some losing all, and others the greater part of their children, after a few days indisposition. Some others of the neighbouring places were affected at the same time with the like disease, which, from all the accounts I have met with, from those who attended the sick, was that here treated of. I am informed likewise that it raged at Greenwich about the same time.

It still continues in this city, and sometimes shews itself in the villages about it, though at present with so mild an aspect, as seldom to prove fatal, unless the subject is very unfavourable, or the disease hath been neglected, or improperly treated at the beginning, which circumstances, tho' of some importance in all cases, yet are of the utmost in this, as a wrong step at the first may put it out of the power of art to afford relief

Tho' this disease has now been amongst us several years, and

^{*} The reader may be pleased to take notice, that the facts contained in the following narrative, where the contrary is not expressly mentioned, have all come under the author's observation, who has endeavoured to relate what he has seen, and only what he has seen, in such a manner as he thought would best contribute to public advantage. It may also be necessary to observe, that the disease is described, as it appeared in 1747 and 1748, that if the symptoms should hereafter vary in any circumstance, the diversity may be attributed to the nature of the distemper, and not imputed to design or inattention

has consequently survived the different seasons, and all the variety of weather to which we are exposed, yet it seems to shew itself most frequently in autumn and the beginning of winter, at least I have met with many more cases from September to December inclusive, than in all the other months together

It may likewise be remarked, that the summers of 1747 and 1748 were dry, with some days in each uncommonly hot, for (p 30) this climate, the mercury in Fahrenheit's thermometer rising in the shade, and within-doors, one day to 78, and during several to 75 and 6 The autumns of the same years were as unusually temperate and warm, the wind continuing longer in the southerly points than has often been known at this season

In this country, as well as in those where the Angina maligna was first taken notice of, children and young people are more exposed to it than adults A greater number of girls have it than boys, more women than men, and the infirm of either sex are more liable to have the disease, and to suffer from it, than the healthy and vigorous I have seen very few grown people of this class who had it, and not one who died of it

If it breaks out in a family, all the children are commonly affected with it, if the healthy are not kept apart from the sick, and such adults as are frequently with them, and receive their breath near at hand, often undergo the same disease

It generally comes on with such a giddiness of the head, as often precedes fainting, and a chilness or shivering like that of an ague-fit This is soon followed by great heat, and these interchangeably succeed each other during some hours, till at length the heat (p 31) becomes constant and intense. The patient then complains of an acute pain in the head, of heat and soreness, rather than pain, in the throat, stiffness of the neck, commonly of great sickness, with vomiting, purging, or both b The face soon after looks red and swelled, the eyes inflamed and water, as in the measles, with restlessness, anxiety, and faintness

b The vomiting and purging were but seldom observed to accompany this disease, at its first appearance amongst us, as I have been informed by some physicians of eminence, who saw it early, but it is generally agreed, that these symptoms almost constantly attended, in the manner here described, during the years 1747 and 1748, the time in which these observations were collected. And I have found, that within these three months, the above mentioned symptoms have not so regularly appeared as before

This disease frequently seizes the patient in the fore part of the day. As night approaches, the heat and restlessness increase, till towards morning, when, after a short disturbed slumber (the only repose they often have during several nights), a sweat breaks out, which mitigates the heat and restlessness, and gives the disease sometimes the appearance of an intermittent

If the mouth and throat be examined soon after the first attack, the uvula and tonsils appear swelled, and these parts, together (p 32) with the velum pendulum palati, the cheeks on each side near the entrance into the fauces, and as much of them and the pharynx behind as can be seen, appear of a florid red colour. This colour is commonly most observable on the posterior edge of the palate, in the angles above the tonsils, and upon the tonsils themselves. Instead of this redness, a broad spot or patch, of an irregular figure, and of a pale white colour, is sometimes to be seen, surrounded with a florid red, which whitness commonly appears like that of the gums immediately after having been pressed with the finger, or as if matter ready to be discharged was contained underneath.

Generally on the second day of the disease, the face, neck, breast, and hands to the finger ends, are become of a deep erysipelatous colour, with a sensible tumefaction; the fingers are frequently tinged in so remarkable a manner, that, from seeing them only, it has not been difficult to guess at the disease

A great number of small pimples, of a colour distinguishably more intense than that which surrounds them, appear on the arms, and other parts. They are larger, and more prominent in those subjects, and in those parts of the same subject, where the redness is least intense, which is generally on (p. 33) the arms, the breast, and lower extremities ^a

As the skin acquires this colour, the sickness commonly goes off, the vomiting and purging cease of themselves, and rarely continue after the first day

The appearance in the fauces continues to be the same, except

^a The redness and eruption have not accompanied this disease so regularly, during the latter part of this winter, as they did in the preceding seasons. In some cases they did not appear at all, in others not till the third or fourth day, and, as I have heard, in some not till the fifth, and even later

that the white places become of a more opake white, and it is now discoverable, that what at first might have been taken for the superficial covering of a suppurated tumor, is really a slough, concealing an ulcer of the same dimensions

All the parts of the fauces above-mentioned are liable to these ulcerations, but they generally are first discernible in the angles above the tonsils, or on the tonsils themselves, though they are often to be seen in the arch formed by the uvula, and one of the tonsils, also on the pharynx behind, on the inside of the cheeks, and the base of the tongue, which they (p 34) cover in the manner of a thick fur—Instead of these sloughs, where the disorder is mild, a superficial ulcer, of an irregular figure, appears in one or more of these parts, scarce to be distinguished from the sound, but by the inequality of surface they occasion

The parotid glands^b on each side commonly swell, grow hard, and are painful to the touch, if the disease is violent, the neck and throat are surrounded with a large oedematous tumor, sometimes extending itself to the breast, which, by straitening the fauces, increases the danger

Towards night, the heat and restlessness increase, and a delirium frequently comes on This symptom, which appears in some even on the first night, seems to differ considerably from the like affection in other diseases. They commonly answer the questions put to them properly, but with an unusual quickness, they talk to themselves incoherently when left alone, and frequently betray the first tendency to this disorder, (p 35) by affecting too great a composure. This for the most part happens to those who sleep but little, for some are comatous and stupid, and take little notice of anything that passes

In this manner they continue during two, three, or more days, they commonly grow hot and restless towards evening Which symptoms and the delirium increase as night comes on, a sweat more or less profuse breaks out towards morning, and from this

b Heredia takes notice of the same symptom, and assigns a very probable reason for it—In Angina maligna non tument externa, quia in illas ex externis translata materia fuerit, sed quia ita adimplentur interna, ut materiam fluentem non capiant, et sic ad externa dilabitur. Heredia, p. 99

time they are easier during some hours, a faintness only continuing, of which they frequently complain more than of the rest of their sufferings

The disease seems to have no stated period which can properly be called its $A\eta\mu\dot{\eta}$ or Height Some grow easier than the first day of the attack, but, in general, the symptoms of recovery appear on the third, fourth, or fifth day, and proceed in the following manner

First, the redness of the skin disappears, the heat grows less, the pulse, which was hitherto very quick, becomes slower, the external swellings of the neck subside, the (p 36) sloughs in the fauces cast off, the ulcerations fill up, the patient sleeps without confusion, is composed when awake, and his appetite begins to return towards more solid nourishment, than has hitherto been allowed him

The pulse, during the whole course of this disease, is generally very quick, frequently 120 strokes or more in a minute. In some it is hard and small, in others soft and full, but without that strength and firmness which usually accompany equal quickness and heat in genuine inflammatory disorders

If a vein is opened soon after the distemper is come on, the blood generally appears of a fresh florid red, the Crassamentum is rather of a lax gelatinous texture, than dense or compact, the serum yellow, and in a large proportion d

The urine is at first crude, and of a pale whey-colour. As the disease advances, it turns yellower, as if bile was diluted in it, and soon after the patient shews any marks of recovery, it commonly grows turbid, and deposits a farinaceous sediment.

They seldom have any stools, if the symptoms are favourable, from the time when (p 37) the purging, which generally attends the accession, ceases This discharge is frequently bilious, and without any pain. Tho' these evacuations differ in different habits

^o At least, of all the parts about the neck, except the parotids themselves, which sometimes continue swelled and hard a long time after the other symptoms abate, and at length suppurate

d But it is often fizy when the disease has continued two or three days, and in some instances which lately occurred, it was so, soon after the first attack.

They complain of thirst commonly less in this than in other acute diseases. The tongue is generally moist, and not often furred. In some nevertheless it is covered with a thick white coat or fur, and those who are so affected, often complain of soreness about the root of the tongue

The uvula and tonsils, tho' they are sometimes so much swelled, as to leave but a very narrow entrance into the gullet, and this entrance frequently surrounded with ulcers or sloughs, yet the patients often swallow with less difficulty and pain than might be expected under such circumstances.

They frequently complain, soon after they are taken ill, of an offensive putrid smell, affecting their throats and nostrils, which oft occasions sickness before any ulcerations appear

In those who have this disease in a severe manner, the inside of the nostrils, as high up as can be seen, frequently appears of a (p 38) deep red, or almost livid colour. After a day or two, a thin corrosive sanies, or with it a white putrid matter of a thicker consistence, flows from them, which is so acrid, as to excoriate the part it lies upon any considerable time. This is almost observable in children, or in young and very tender subjects, whose lips likewise are frequently of the colour above-mentioned, and covered on the inside with vesicles containing a thin ichor, which excoriates the angles of their mouths, and the cheeks where it touches them

It is probable, that part of the same acrid matter passes with the nourishment into the stomach, especially in children, and it is perhaps owing to this cause in part, that they suffer much more from this distemper than adults, this corrosive fluid without doubt producing the same effects on the stomach and bowels, as it does when applied to the much less sensible skin of the face, ie it excoriates the parts it touches, which in fact seems to be the case. For, if they get over the disease, a purging sometimes succeeds it, attended with the symptoms of ulcerations in the bowels, and after enduring great pain and misery, perhaps some weeks, they at length die emaciated. I have been informed, that

^{*}I have seen a few cases, where these glands were so enlarged, as to force back thro' the nostrils a considerable part of the nourishment they took

some children have had the parts about (p 39) the anus excornated, the sames retaining its virulency thro' the whole tract of the intestines

The sick sometimes bleed at the nose towards the beginning of the disease, and the menses very often appear in those of the female sex, who are of age to have them, soon after they are seized, notwithstanding the regular period is at a considerable distance. If they are taken ill about the usual season, the discharge is commonly greater than it ought to be. Some young persons, who never had the least appearance of them, have had this evacuation during their illness.

In strong and full habits, these evacuations are seldom attended with much benefit, or manifest ill effects, unless they are very copious, for in this case they occasion great faintness, and an increase of the other symptoms, in proportion to the excess. In tender weak subjects they are often prejudicial

It has happened in this disease, that hemorrhages from the nose and mouth have suddenly carried off the patient. I have heard of the like accident from bleeding at (p. 40) the ear. But these fatal discharges most commonly happen after the patient has been ill several days, and it seems more probable, that they proceed from the separation of some slough from the branch of an artery, rather than from a fullness of the vessels, or an effort of nature to relieve herself by a salutary crisis ^g

Bleeding in this disease has in general been observed to be prejudicial Some indeed admit of it at the first attack, without any sensible inconvenience, but a repetition of it, even where the

Some adults, who have had the disease in a violent degree, have suffered very much from the same cause Emolliet mucilaginous liquids taken plentifully, and also applied externally, by way of fomentation, to the part affected, frequently give speedy relief

This I find was also Heredia's opinion, who considers a discharge of blood either from the mouth or nose, as a sign of the utmost Danger—Malignam significationem praebet segnis sanguis stillans e naribus, ex corrosione quippe vasorum, et putrilagine emanat, innuitque certissimam mortem, quia putredo interne cohiberi non potest—ideo periculosissimus consetur sanguinis fluxus ex naribus aut ore Quidam cum hog signo nullum vidisse liberatum docent nos vero unicum solum aegrotum summa dilligentia a tanto periculo vindicavimus. Heredia, p 100. Tho' of three whom I attended, and who had this symptom, two recovered, the third died of a bleeding at the nose, before any assistance could be procured

disease is mild and favourable, seldom fails to aggravate the symptoms; and in some cases it appears to have produced very fatal consequences. The heat, restlessness, delirium, and difficulty of breathing, which this evacuation commonly prevents or mitigates in other cases, in this are increased by it, nor does (p 41) the swelling of the tonsils, fauces, &c seem to receive the least benefit from it. On the contrary, tho' the fulness of these parts decreases, yet the sloughs thicken, and change to a livid or black colour, the external tumor grows large, and the spitting commonly diminishes h

Nor has purging been observed to be more beneficial Gentle cathartics have brought on very dangerous symptoms. Upon procuring a few stools with manna, especially when the disease has continued two or three days, the redness of the skin has disappeared, and the flux to the throat has been surprisingly increased. If it happens that this discharge by stool continues, the swelling of the neck commonly grows larger, the fauces become flaccid, dry, and livid, and the patient in a few hours after this expires. So that purgatives seem to have no better effects in diminishing the tumor, and abating the supposed inflammation, than bleeding

(p 42) Nitrous cooling medicines frequently produce the like effects, they increase that faintness which accompanies this disease, and either dispose the patient to copious sinking sweats, or to stools

Upon the whole, it appears, that all evacuations which tend to lessen the natural strength of the constitution, are in this disease injurious, and that those persons in common are in the greatest danger, if attacked with it, who have been previously indisposed, or have had their strength impaired by grief, or any other accident. Of which it may not perhaps be improper to relate an instance or two in this place, as it will also tend to explain the usual progress of the symptoms in the worst cases we meet with

h The heat indeed and quickness of the pulse seem at first to be affected by this evacuation, but they commonly return after a fallacious respite with greater violence, the patient is seized with a difficulty of breathing, falls into cold sweats, a stupor, and dies suddenly

A young gentlewoman about 26 years of age, of a pale lax habit, but of an active chearful disposition, had enjoyed a pretty good share of health in common, till a year or two before her last illness, about that time she unhappily made use of some external and empirical application to remove a redness attended with pimples, which now-and-then broke out in her face. She was soon relieved from this complaint by the medicine she used, but was quickly after seized with sickness, vomiting, loss of appetite, and either an obstinate costiveness, (p 43) or a troublesome diarrhoea, the menses were pale, and in small quantities, and her health in general was greatly impaired

She had scarce recovered from this weak state, when the death of a near relation brought her almost into the same circumstances, from which she was slowly recruiting, when she married Her sickness, vomiting, and loss of appetite, soon returned, which she concealed as much as possible

Under these disadvantages, she was seized with this distemper, a day or two after she had visited an acquaintance labouring under the same disorder It came on with a coldness and trembling like that of an ague-fit, great faintness, and an acute pain in her head, with a vomiting more violent than she was usually affected with, and a purging Towards evening she grew very hot and restless, complained of a soreness in her throat, and the discharges abated Her face, neck, and hands were intensely red, she frequently sighed, and from her aspect and gestures there was reason to suspect a delirium approaching She slept little that night, and next morning her pulse, which before was very quick and small, seemed to be somewhat more full, but not sensibly slower, and she complained of faintness and anxiety The parts about the fauces were much relaxed, very red, in some places almost livid, (p 44) with a kind of glossy dryness upon them She continued in this manner, without any remarkable increase of symptoms till night, when the looseness returned, and in a very short time exhausted her strength to a great degree. The redness upon the skin disappeared, the extremities grew cold, her eyes became dim, her pulse scarce perceptible, she breathed

with difficulty, and expired in the morning, on the third day of the disease

Another young woman, who frequently visited, and sometimes assisted a relation, who had this disease, was attacked with it in the usual manner. She was about 17, of a pale and somewhat bloated lax habit, naturally inactive, averse to exercise, and was thought to have indulged some painful solicitude, to the prejudice of her health, and making way for an obstinate chlorosis

Under these circumstances she was seized with the usual complaints, but in a violent manner. The purging continued till the day following, when it yielded for the present to opiates, but constantly returned when their effects were over. The other symptoms, such as heat, restlessness, anxiety, and faintness, increased with the purging, the pulse was small, quick, and hard, a difficulty of breathing came on, the small remains (p 45) of lustre in the eye perished, and she died early on the fourth day of the distemper

No marks of any sloughs in the throat appeared in either of these cases, but the redness became daily more intense, and approached nearer to lividness, whilst the fauces could be inspected, which, from the great difficulty they had in breathing, was impracticable several hours before the patients expired.

Warm aromatic cordials, and anodyne astringents, were administered assiduously, with suitable nourishment, and vesicatories applied successively to the neck on each side, the shoulders and arms, but without effect

If the purging therefore continues long after the first exacerbation of the disease, it may be looked upon as a dangerous symptom, for tho' it be sometimes restrained for the present by opiates or astringents, yet it commonly returns with more vehemence, when their efficacy ceases, and in a short time exhausts the small degree of strength remain

In this case they generally spit very little, the fauces appear dry, glossy, and livid, the external tumor grows large, they void their excrements without perceiving it, and fall into profuse sweats, respiration becomes (p 46) difficult and laborious, the pulse sinks, the extreme parts grow cold, and death in a few hours closes the scene, and in no disease that I have seen is the eye so early deprived of its lustre as in this, for it is sometimes opake or dim several hours before death, and, as Aetius Cletus hath observed, is a fatal presage of its approach i

A copious flux of pituitous matter to the glands, and other parts about the fauces, (p 47) seemed to be the cause of sudden death, in a girl about 12 years old She was seized in the common way, with shivering, headache, sickness, vomiting, and purging The discharges abated in a few hours, and were succeeded by great heat, redness of the skin, and a sore throat, the uvula, tonsils, and contiguous parts were red, and so swelled in eight or ten hours, as to touch each other, and seemed to close the entrance into the pharynx She breathed without much difficulty, swallowed with less pain than could be imagined, and spit up large quantities of phlegm About six in the evening she was seized with a difficulty of breathing, as if strangled Those about her raised her up, thinking she was in a fit, she recovered herself a little, but expired upon being again laid down in bed, in somewhat less than 24 hours from the first attack large quantity of viscid phlegm, with which, after she was dead, her mouth appeared to be filled, together with the tumefied uvula, tonsils, and velum palati, had perhaps jointly closed the Rima Glottidis, and put a stop to respiration

By a fall in her infancy she was reduced to the necessity of using crutches She was big-boned, had a good appetite, and

'Heredia's description of this fatal progress of the disease, and the necessary cautions he gives in respect to the prognostic, deserve particular notice

Fallacissimam esse hujus morbi naturam, consitentur omnes—ulceribus oris, et partium quae visui existebant conspicuae, recte curatis, et sedata inflammatione aeger periclitatur—ex eo quod paulatim serpit putedo per asperam arteriam ad cor, aut per gulam ad ventriculum, sine aliquo dolore, aut febre sensibili, cujus sit habenda cura et cum medicis auxiliis, ablata fuerint ulcera, et inflammationes sedatae in partibus vifui patentibus, occulta putredo, paulatim mortificans partes internas, tabe, parvissimis et debilissimis pulsibus extinctione caloris, refrigeratione extremorum faciei extenuatione, inappetentia perpetua, et molesta mutatione decubitus, somno fallaci, et apparente, quia vigilandi impotentia, somnum verum aemulatur, misere aegrotantes interficit, ut visum jam sit subita et inopinata morte periisse aliquos,—e lecto surgentes, et intra domos ambulantes, ob quod etsi quae vitiata apparebant in faucibus, aut partibus aliis, in melius mutata conspiciantur, non licet salutem polliceri, quia solet communicari paulatim putredo, et gangraena partibus internis Heredia, p 99

for want of that exercise, which persons at her age commonly enjoy, seemed to be plethoric (p 48) These circumstances perhaps might contribute to this speedy and unhappy event Accidents of the like kind seem not to have been uncommon

Accidents of the like kind seem not to have been uncommon while this disease continued in Italy, according to a remark of Cortesius ^k

From the preceding account of the sore throat attended with ulcers, it will, I believe, appear, that this disease is widely different from a common sore throat, or simple inflammation of any of the parts about the fauces, both as to the subject commonly affected by it, the manner of its attack, the progress of the symptoms, and its conclusion For the sore throat with ulcers generally attacks children, and of these, girls more frequently than boys, as hath been observed. If adults are seized with it, they are commonly such as have been very much conversant with the sick, or else (p 49) are weak and infirm. And it seems to affect those adults in the severest manner, who have been previously indisposed, or whose strength has been reduced by unseasonable or immoderate evacuations

On the contrary, the common angina, or an inflammation of the tonsils, most frequently attacks the healthy, the vigorous, and robust, the weak, the delicate, and infirm, are less exposed to it, at least suffer less from it, than the former

As both diseases are attended with a fever, and as most fevers come on with a shivering or chillness, this symptom may at least appear equivocal. But if sickness, or vomiting, or purging, or an acute headache, towards the back parts or top especially, or if all these, come on in the space of a very few hours, which they generally do, where the disease is vehement, it may justly be esteemed to be of the putrefactive kind But if with these symptoms an erysipelatous redness discovers itself in the fauces, with ulcerations or sloughs, the disease is evident

k Ad praedictarum partium (uvulae, tonsillarum) inflammationem subsequebatur interdum materia quaedam pituitosa a capite tam repente et inopinato descendens, ut miseri aegrotantes subito suffocarentur Cortes Miscell p 697

¹ The disease here treated of is, strictly, a sore throat, since by soreness we aptly express the uneasy sensation accompanying an ulcer (i e a sore) and not that which attends an inflammation, which is indeed pain, but not properly soreness

In some cases, the symptoms have been so obscure, that it was difficult to determine to which disease they properly belonged: But in these circumstances they were commonly so favourable, that, supposing the disorder not to be of the ulcerated kind, no other inconvenience (p 50) seemed likely to ensue from treating it as such, than a suppuration, which is often an event rather to be chosen than avoided

The redness of the skin in the face, neck, breast, and hands, is another obvious and distinguishing characteristic, which in children and young people especially, seldom fails to accompany this disorder

In the common sore throat, a local inflammation is the disease All the symptoms are derived from this source. An acute throbbing pain, greatly increased upon swallowing even liquids, is the principal grievance. In the other, the whole habit suffers, as if by a stimulus of a peculiar nature, and although the throat is always more or less affected, yet it is sometimes the least part of the patient's complaint, and instances have occurred to me of considerable sloughs being formed, before any soreness or pain in the fauces hath been mentioned

Again, this disease is accompanied with a greater tendency to a delirium, than either a common angina, or almost any other disease we are acquainted with. To have this symptom appear in the disease we are treating of on the first night, is not uncommon, and on the second, frequent. A girl about eight years of age, whom I attended, was scarce known to be indisposed, till she alarmed the family, by appearing (p 51) to be light-headed. She had made no complaint of her throat, nor was this part thought to be affected, till, upon examination, I found it so, being led to suspect it by the colour of her hands, and the delirium. She got well through the disease, tho' its progress, at first, appeared to be very swift.

A common sore throat, if the patient recovers, either goes off by resolution, or the parts affected suppurate, or, if glandular, become hard and scirrhous

In that attended with ulcers, none of these circumstances happen, for it terminates in a superficial ulceration of some of the

parts about the fauces, with little appearance of any sloughs, if the disease is very mild, and with large and deep ones, of a white, cineritious, livid, or black colour, if it is more violent

It will not perhaps be difficult, from this comparative view, to distinguish this disease from a common sore throat, or an inflammatory affection of those parts. But there is another no less certain criterion, tho' too often a fatal one, which is, the constant increase of symptoms upon bleeding, purging, and the liberal use of cooling antiphlogistic medicines. A method, which as seldom fails removing a genuine inflammation, if it is early enough and assiduously pursued, as it is too often injurious in the present case. (p. 52) An instance whereof I think evidently appeared in the following case.

A youth of about 14 years old, of a brisk lively disposition, who had enjoyed a good share of health, saving that, for a few years past, a cutaneous disease, akin to a leprosy, had sometimes appeared on his head and arms, was seized one morning with a general uneasiness, and a disposition to vomit, he was put to bed, and a severe shivering ensued, his sickness increased, he vomited up everything, had several purging stools that day, and complained much of his head, with some soreness in his throat. He was ordered to be blooded, and had an emetic given him. This operated but little, he grew hot and restless, a deep redness spread itself over his face, hands, and arms, with a plentiful eruption of small pimples, which induced those about him to apprehend it was a common scarlet fever

The next day, which was the second of the disease, his throat continuing sore, and the feverish symptoms increasing, a purge of manna was given him, which operated gently, and at night his head and throat being more uneasy, his heat still continuing, with a tendency to delirium, a blister was applied

On the third, the symptoms not abating, he lost about ten ounces of blood He had taken (p 53) a cooling nitrous powder every four hours, this was now changed for one more cordial At night he grew delirious, his fever increased, and he had some loose stools, which were rather encouraged than restrained, as it

was hoped they might relieve him Blisters were applied to his head and arms

On the fourth in the morning I was sent for I found him delirious, with convulsive twitchings, his hands in constant motion, gathering the bed-cloaths, his pulse quick and weak, his tongue parched With some difficulty I looked into the fauces, they seemed to be pale in some places, intensely red or livid in others, with a glossy brightness His excrements came away involuntarily, his eyes were languid, and dim, he breathed with difficulty, fell into profuse clammy sweats, and died in a few hours after

In some of the first cases I met with, the quickness of the pulse, the degree of heat, the apparent inflammatory redness of the eyes and face, and pain in the head, sometimes urged me to order bleeding, especially if there were any marks of a plethora, but in these cases it did not appear to have any advantageous effects. So that, notwithstanding the urgency of the symptoms above mentioned, it seems proper in general to omit this evacuation

(p 54) Cupping with scarification has been applied to the shoulders and back of the head, in order to remove an acute pain of this part, which is often complained of, but, as far as I have been able to observe, without much benefit

It is necessary that the patient should keep in bed as much as may be, tho' the disease should seem to be slight. It has happened, for want of care in this respect, that a purging has come on, the redness of the skin disappeared, and a disorder, which with confinement alone would probably have gone off in twice 24 hours, had been rendered tedious and difficult

If we are called in at the first, while the sickness or vomiting continues, it will be of use to promote this discharge, by giving an infusion of green tea, chamomile-flowers, carduus, or a few grains of ipecacuanha In some instances, where the attack has been severe, and this method practised, the disorder has gone off with more ease than was at first apprehended

If these symptoms don't abate with the operation of the emetic, small draughts of mint-tea, with a sixth part of red port added to it, may be given frequently, together with some grateful

and warm aromatic, cordial medicine, every four or six hours. The Pulvis Contrayervae simp — (p 55) comp Confect cardiac. —Raleigh Spec arom Vinum croceum, Aq. Menth spirit cum aceto, with others of the like nature, may be used for this purpose

In this disease it is at all times necessary to attend very carefully to the diarrhoea. For the most part it ceases with the vomiting, in less than twelve hours from the first attack. If it continues longer than this period, it is necessary to check it, otherwise it occasions great faintness, sinks the strength, and in the end produces very dangerous consequences. The aromatic cordials above mentioned, if they are given plentifully, commonly take off this symptom, as well as the vomiting, but if they prove ineffectual, recourse must be had to astringents and anodynes, in proportion to the exigence of the case, such as the Confectio Fracastorii, or Elect e Scordio, dissolved in small cinnamonwater, and given post singulas sedes

It is common for the redness, so often mentioned, to appear upon the skin, as these (p 56) discharges abate. It has happened that this colour has gone off sometimes, and the patient has been brought into imminent danger, upon giving a mild cathartic Which circumstances, as they point out a close connexion between them, indicate the use of a warm regimen, notwithstanding the heat and other symptoms might seem to forbid it

A girl about 9 years old, of a slender make, but healthy and active, was seized with this disorder. The sickness and vomiting went off, and the redness of the skin appeared soon after. The apothecary who attended her, judging it an inflammatory case, as she complained of her throat, bled her, gave her a cooling purge the next day, and afterwards some nitrous draughts. A plentiful efflorescence which covered the face, neck, and arms, suddenly disappeared, a diarrhoea came on, she grew restless,

m Vegetable acids, such as the juice of lemons, oranges, wood-sorrel, verjuice, vinegar in small doses, and the like, as they are undoubtedly antiputrescents, may seem to be indicated, but their proneness to increase the discharge by stool, or profuse sweats, ought to render us very circumspect in using them

faint and insensible In this condition I first saw her on the third day of the disease, she frequently sighed, her pulse was quick, small and hard, without any remarkable colour upon her skin, and the swelling on each side of the neck large. It was not possible to examine the fauces, as she lay in a comatous helpless condition, her stools and urine coming away insensibly. A warm cordial (p. 57) mixtureⁿ was frequently given her, upon which the diarrhoea soon abated, and the next day the efflorescence again appeared upon her face and arms. From this time she continued to recover, tho' slowly, and was for some time attended with a cough and hectic heats

Another symptom, which requires our attention in the cure of this disease, is an excessive faintness. Of this they generally complain soon after they are taken ill, and continue to do so, if sensible, till the distemper begins to abate. The urgency of this symptom seems to indicate the degree of danger. It is more or less violent, as the disease is mild or malignant, and an abatement of it may be looked upon as a sure presage of recovery

Warm aromatic and gently stimulating medicines, such as have been already mentioned, as the most effectual to suppress the vomiting, and check the looseness attending this disease, have likewise been found useful in removing the present complaint. And tho' the degree of heat, and quickness of the pulse, would be enough to dissuade a person who has not seen the disease, from giving them in so liberal a manner as necessity requires, (p 58) yet we are not to be governed so much by these symptoms, as by the faintness, despression of the pulse, and increase of putrescency in the fauces. One drachm of the Confectio Raleighana has been given to a youth not quite 15 years of age, every four hours, which was soon followed by a sensible amendment, and the decrease of the patient's restlessness, faintness, and heat

Some of the Italian physicians forbad the use of wine in the cure of this disease, and the warmth of that climate might per-

ⁿ Rx Aq alexet simp 5 vj Alexet Spri cum Acet 5 jfs Con cardiac 3 jfs Pulv Contray simp 3 fs Syr Croc 5 ss f Mixt de qua capiat aegra coch ij tertia quaque hora

haps make this caution necessary, but as it is a generous cordial, and at the same time antiseptic, it seems to be in no respect improper here, and, besides in whey, I have allowed it to be given, in small quantities, mixed with mint, baum, or sage-tea, barley-water, gruel, panada, sago, and the like, and alone, where the faintness has been excessive, the age, the former way of life, and the symptoms, affording the necessary rules as to quantity Chicken-water, or thin broth, may also be allowed, which is frequently very acceptable to the patient. And I don't remember to have observed so general and early an inclination after solid food, in any acute disease, as in this For at a time when one would imagine, both from the condition of the fauces, and the degree of heat, that liquids would be the most acceptable, it is not uncommon to find (p 59) children, who have this disease, extremely desirous of chicken, and chearfully complying with directions, in hopes of being gratified in this respect

Blisters are likewise of use to relieve the faintness. At first I was in doubt, lest the flies, by their acrimony, should increase the putrescent disposition, and consequently aggravate the disorder they were intended to remove. But no such effect having appeared from their use, I have ordered them to be applied, and I think with advantage, both to the usual parts, and to the neck on each side from below the ear almost to the clavicle, as occasion required •

The ulcers in the throat demand our early and constant attention, as a considerable loss of substance cannot here be suffered without immediate danger to life itself, or the most injurious consequences to the future action of the parts, if the patient survives

Where the disease is of the mildest kind, a superficial ulceration only is observable, which may easily escape the notice of a person unacquainted with it. A thin, pale, white slough seems to accompany the next degree. A thick, opake, or ash coloured one is a further advance. And if the parts have (p. 59) a livid or black aspect, the case is still worse. These sloughs are not formed

[°] It has been observed by several, that the discharge from blisters in this disease, is in general both more copious at first, and continues longer than is usual in other cases

of any foreign matter spread upon the parts affected as a crust or coat, but are real mortifications of the substance, since whenever they come off, or are separated from the parts they cover, they leave an ulcer of a greater or less depth, as the sloughs were superficial or penetrating

When the tendency to putrefaction is stopped, these sloughs in most cases come off spontaneously, or their separation may be promoted by suitable remedies and applications. But it seems by no means adviseable to attempt it by force, or to scrape them off with the fingers or instruments, as Severinus proposes, since the experiment has been tried, but with such unhappy consequences, as are sufficient to discourage one from persisting in this method q

(p 61) In a case where I was concerned, previous to my being called in, a surgeon had endeavoured to separate the sloughs by the assistance of his probe: He succeeded in his attempt without much difficulty, but was surprised to see the same parts covered the next day with thick, dark, ash-coloured sloughs, penetrating deep into the substance

It is true, the sloughs have been sometimes scarified, from an apprehension, that matter was lodged underneath them, without any manifest inconvenience, but as there are instances of fatal mortifications having ensued, it seems most prudent to decline the practice

From under these sloughs, and from every part of the ulcers

p Si quis tamen vel digitis, vel aliquo instrumento levi ipsam (materiam albam) auferre tentasset, quamvis operatio haec fieret absque dolore, ea tamen ablata brevissimo tempore peribant aegrotantes, quod prae caeteris in Petro Soprano genero meo observatum est, cui cum hujusmodi mortificatio apparuisset in suprema superficie dictarum glandularum faucium, et palati, ita ut videretur esse maximo respirationi et deglutitioni impedimento, chirurgus existimans posse facillimo negotio a subjectis partibus eam separari solis digitis, levissime quidem eam abstulit, quae ablata, tantum abest ut juverit deglutitionem aut respirationem, ut utraque potius actio laesa magis fuerit, unde brevissimo tempore miser, meo cum maximo dolore, mortem oppetiit, id quod etiam in aliis quamplurimis pueris saepius observavi, et praesertim in ejusdem Petri filiolo nepoti ex filia, quinque annorum, mihi carissima, qui post paucos dies eodem modo, quo pater, vitam cum morte mutavit Cortes Miscel Med p 697

^q Quod si enim adhaerentem adhuc crustam avellere aggrediamur, ulcerationes magis in profundum procedunt, et inflammationes consequentur, augentur dolores, et in ulcera sperentia proficiunt Heredia, p 109

which they cover, a thin corrosive ichor is discharged, so acrid as to excoriate the external parts upon which it is suffered to remain. This is sometimes observable in adults, when the parts above the fauces are affected, the ichor in these cases flows (p. 62) thro' the nostrils, and frequently raises pimples and small blisters on the skin of the upper lip, but it is most obvious in children, who often have this part, the corners of the mouth, the cheek of that side on which they most commonly lie, blistered or excoriated

It is probable, as has been already hinted (p 38), that part of the same virulent matter, passing down the oesophagus into the stomach and intestines, acts upon them as it does upon the skin, when applied to it externally, it frets and corrodes the parts it touches, and produces that sickness, vomiting, purging, and faintness, which sometimes accompany this disease in different parts of its progress

In children, and very young subjects, the symptoms arising from this cause are yet more dangerous. The natural softness and laxity of the parts liable to be affected, disposes them to suffer by it much more than adults. At the same time they are commonly alike incapable of promoting the discharge of this matter themselves, and of admitting assistance from others, being generally, if the distemper is not very mild, either comatous and stupid, or delirious and untractable. If gargles are injected, they either prevent them from reaching the seat of the disorder, by their tongues, or they swallow them, and the putrid taint of the ulcers, together, the mischief spreads beyond the power of art to (p. 63) restrain it, violent purgings ensue, or fatal hemorrhages from the penetrating gangrene. And to this, perhaps, it may in part be owing, that children suffer so much more from this kind of sore throat, than adults r

That this corrosive matter produces these effects, is farther confirmed, by observing, that those whose throats are severely

^r Heredia takes notice of the same thing, and gives it as a principal reason why so many infants and children suffered by this disease

Infantium et puerorum multitudo maxima periit, quia nec exspuere, nec excreare lentas et crustaceas materias possunt, et minus auxiliis obediunt —p 100

affected, if they have a plentiful discharge from the fauces, are seldom attended with sickness, vomiting, or excessive faintness, tho' after longer sleeps than ordinary, or a neglect of encouraging this evacuation, they have complained of sickness, and have had reachings come on. Likewise, that in such cases, where little or no discharge of this kind appears, the symptoms are commonly the most dangerous

From hence it is obvious, that great advantages may be expected from the constant use of gently stimulating aromatic gargles, as they promote the discharge of the pituitous matter flowing to the fauces, and, doubtless, with it, of some part of the corrosive fluid above mentioned. To which if we add antiseptics and detergents, in order to (p 64) check the progress of the mortification, and cleanse the sordid ulcers it produces, every indication is provided for

Where the disease is mild, the symptoms favourable, the sloughs superficial, or scarce perceptible, it may be sufficient to order a gargle of sage-tea with a few rose-leaves added to the infusion, three or four spoonfuls of vinegar may be mixed with half a pint of the tea, and as much honey put to it, as will leave it agreeably acid

But where the symptoms are urgent, the tendency to putrefaction great, the sloughs large and thick, and the breath offensive, recourse must be had to more efficacious remedies. A composition like the following, varied only as the patient's age and the circumstances of the disease required, has in general been attended with very good effects. The proportion here given may be used for adults, and the more active parts lessened for younger subjects

Rx Decoct Pectoral 5 xij. cui inter coquendum add Rad. Contayerv. contus 5 fs Liquori colato admisce Acet Vin Alb 5 ij Tinct Myr 5 i Mel opt 5 vi f Gargarisma

As the parts about the gullet are frequently so much affected, as to render it (p 65) painful or impracticable for the sick themselves to make use of the gargle so freely as they ought, it is commonly ordered, that a few spoonfuls of this liquor, made somewhat warm, should be very often injected into the fauces

with a small syringe, and especially before the patient swallows any thing, in order to wash off as much as possible the putrid sordes adhering to the ulcers, and prevent it from passing into the stomach and bowels. In young subjects this method is the more necessary, as they don't always know how to manage a gargle to any purpose, did the soreness of the parts permit them to do it.

As so much depends upon the frequent use of gargles, or rather of injections, a strict attention to this affair, can scarcely be too strongly enjoined to those who have the care of the sick committed to them, since an assiduous repetition of these lotions not only promotes a discharge from the glands of the throat, which is probably of great (p 66) use^u, but retards the progress of the ulcers, by washing off the putrefactive corroding virus, and prevents a large train of very dangerous symptoms (See p 62), and has therefore been strenuously insisted on by several writers, by Mercatus especially *

(p 67) If the sloughs are large, and cast off slowly, they may

The same caution was given by Heredia, and almost in the same terms—Cujusque rei deglutitionem praecedat excrementorum oris excreatio, detersio, ne lotione venenosa excrementa cum rebus deglutiendis ferantur ad viscera p 109

t cum pueri nequeant gargarismatis uti, injiciantur cum syringa Idem ibid

^u Heredia, after having observed, that no evacuations by stools or sweat were of use in this disease, admits that some advantage may be expected from this discharge Est autem aliqua spes in frequenti expuitione, quando crassa et glutinosa excreatur p 100

As I had not an opportunity of seeing this author's works till the first pages of this edition were printed off, I could not mention him with the rest, to whom I had recourse for information respecting the symptoms at the first appearance of this disease in Europe He was physician to Philip IV of Spain, and in his Disputationes de Morbis acutis printed in the third tome of his works, he treats of this disease expressly in several chapters, under the title of Angina maligna. His history of the symptoms contains several things not mentioned by any other author I have seen, so that tho' he was probably among the last of the Spanish physicians who wrote upon this subject, yet the diligence of his predecessors seems not wholly to have exhausted it. In the second edition of his works, which was that I made use of, nothing appears to determine the exact time when his account was published, but as he mentions the Polyanthea of De la Parra, which, according to Ren Moreau in Bartholine's Epistles, was printed at Madrid in 1625, that it must have been after this time, is certain—This edition of Heredia was published at Lyons under the title of Petri Michaelis de Heredia, Complutensis—Philippi IV Hispaniarum regis Archiatri—Operum Medicinalium Editio altera. Lugduni 1673

* Cavendum est diligenter, ne sic affecti deglutiunt propriam salivam, quinimo ora puerorum diligentissime sunt abluenda Mercat p 137 be touched with Mel Aegyptiacum, by means of an armed probe, or if the condition of the fauces is such, that this cannot conveniently be done, a spoonful of the following mixture may be injected, and retained in the throat, as long as the patient can endure it, the parts may then be washed two or three times with the gargle alone.

Rx Gargarism praescript 3 11 Mel Aegypt.

By the constant and regular use of these applications, if the patient is kept warm, and the method of treating him in other respects is observed, agreeable to what has been mentioned above, it seldom happens but that the febrile symptoms disappear, the sloughs come off, and the ulcers are disposed to heal in a few days, unless it be where mismanagement at first, malignity of the infection, or an unfavourable constitution, have one or all contributed to increase the disease, and to render its consequences more lasting and mischievous

What effects improper treatment produces in this case has already been observed With regard to the matter of contagion, or the nature of that cause which so suddenly brings on such a train of symptoms as hath been described, little can be said with any (p 68) degree of certainty. Thus much, however, seems to be true in fact, that in some cases this disease appears to be of so mild a nature, and so benign, as to require but little assistance from art. Persons even recover from it under the disadvantages of unskilful and injurious management, whilst in others, the progress of the symptoms is so rapid, and the tendency to corruption so strong, that nothing seems able to oppose it Just as it happens in the small-pox, the benign and distinct sort bears ill treatment without injury; in the malignant flux kind, the utmost art and experience are too often insufficient to conduct the distemper to a happy issue Whether this diversity in the sore throat we are speaking of, is owing to a difference of constitutions, or of seasons, to the different quality or quantity of the contagion, or the manner of receiving it, or whether there are in reality distinct species of it; may perhaps hereafter be more certainly determined.

With respect to constitution, it may be further observed, that

in soft, lax, leucophlegmatic habits, and languid inactive dispositions, every thing else being equal, the disease seems to proceed more slowly, to go off more irregularly, and to leave behind it more lasting effects. In some persons of the temperament described, tho' the fever has (p. 69) grown less, and all the symptoms abated in four or five days, yet the sloughs in the throat have continued almost a week longer, whilst in the opposite constitution, tho' the disease has been much more acute, yet the symptoms have no sooner abated, than the sloughs have cast off, and the ulcers healed, of their own accord

A copious hemorrhage from the nose, mouth, or ears, the last especially, coming on after the disease has continued three or four days, or longer, is a dangerous phenomenon. For at this time of the distemper, it most probably proceeds from the branch of an artery destroyed by the mortification, and laid open by the separation of the slough, as hath been already observed. If the vessel is therefore large, the bleeding may prove fatal to the patient in a very short time, or if he escapes for the present, the loss of a considerable quantity of blood at this time of the disease, will occasion various ill consequences

It is therefore absolutely necessary to endeavour to stop this discharge with all the expedition possible. If the patient is costive, it will be of use to procure relief in this respect, by clysters or suppositories, as soon as can be done. To apply vinegar, by means of tents or otherwise, as near to the orifice of the vessel as we can. To convey the steam (p. 70) of it into the fauces and nostrils plentifully, and to keep the patient in a sitting posture, or his head raised as high as may be, and his upper parts moderately cool. If these methods don't immediately take effect, recourse must be had to more efficacious ones, amongst which we may rank the bark and opium

It is not uncommon for hectic heats, night-sweats, want of appetite, and dejection of spirits to attend those a considerable time, who have had the disease in a severe manner. Asses milk commonly relieves them, together with a decoction of the bark, and elixir vitrioli

Having thus related, as concisely as I could, the most material circumstances that have occurred to me in respect to the symptoms, progress, and event of this distemper, the Juvantia, Laedentia, and the accidents chiefly to be regarded in its cure, in such a manner as I hope will enable those who have not seen or known it, to distinguish it from a common sore throat, and to treat it with some degree of propriety and success, I shall conclude with observing,

- 1. That the sore throat attended with ulcers seems to be accompanied with a (p. 71) strong disposition to putrefaction, which affects the habit in general, but the fauces, and the parts contiguous, in particular. And it seems not unreasonable to suppose,
- That the cause of this tendency is a putrid virus, or miasma sui generis, introducted into the habit by contagion, principally by means of the breath of the person affected
- 3 That this virus, or contagious matter, produces effects more or less pernicious, according to the quantity and nature of the infection, and as the subject is disposed to receive or suffer by it
- 4 That putrefactive and malignant diseases, in common, admit of the most sensible and secure relief, from discharges of the peccant matter, either upon the skin in general, or on particular parts of the body.
- 5 That the redness, and cutaneous efflorescence, in the present case may be considered as an eruption of the like nature, and therefore to be promoted by such methods as have proved successful in similar diseases
- 6 That a cordial, alexipharmac, warm regimen has been found by experience to be of the most use in such cases, and that bleeding, purging, antiphlogistics, (p 72) liberally employed, either retard, or wholly prevent these discharges

Therefore, as to expel the morbific matter (3) seems to be the design of nature, to promote this design by the measures that are approved by experience in analogous disorders, is the duty of the physician



Of a Painful Affection of the Face

BY

JOHN FOTHERGILL, M.D.

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To the Medical Society in London Gentlemen,

HEN I related to you, at one of our late assemblies, the purport of the following narrative, several instances of a similar affection were then recollected, cases, which though nearly akin in appearance to the toothache, and that kind of disorder of the jaw which is sometimes umatism, sometimes the ague in the head, and

called the rheumatism, sometimes the ague in the head, and which had not given way to those remedies and applications that in such complaints are most commonly successful in curing them, you then thought that a more particular account of this disease, and the method of removing it, might not be unacceptable to the public for though it does not every day occur, yet to be able to distinguish and to cure, (p 180) with some degree of certainty, a disease, that, during the time it lasts, is extremely excruciating, is an addition, however small, to the utility of our profession

In the third volume of the Medical Observations, among the remarks on the efficacy of hemlock in relieving some anomalous

pains, there is one case mentioned of a person cured by it of a painful disease affecting the face. It is a disease that has occurred to me several times, it seems to be of a singular nature, and so far as I know, althogether undescribed

This affection seems to be peculiar to persons advancing in years, and to women more than to men. I never met with it in any one much under forty, but after this period, no age is exempt from it

The case does not occur very frequently I can recollect but about fourteen instances in the course of my business

This last year I was consulted for two women, one near eighty, the other about fifty years of age, both of them in other respects healthy.

From imperceptible beginnings, a pain attacks some part or other of the face, or the side of the head: sometimes about the orbit of the eye, sometimes the ossa malarum, sometimes the temporal bones, are the parts complained of The pain comes suddenly, and is excruciating; it lasts but a short time, perhaps a quarter or half a minute, and then goes off, it returns at irregular intervals, sometimes in half an hour, sometimes there are two or three repetitions in a few minutes

The kind of pain is described differently by different persons, as may be reasonably expected; but one sees enough to excite one's compassion, if present during the paroxysm.

It returns full as often in the day as in the night Eating will bring it on some persons Talking, or the least motion of the muscles of the face, affects others; the gentlest touch of a hand or a handkerchief will sometimes bring on the pain, whilst a strong pressure on the part has no effect

It differs from the toothache essentially in many respects. It affects some who, from age, have few or no teeth remaining. It most commonly seizes some part above the sockets of the teeth, yet the teeth are sometimes affected with an exquisite sensibility, upon endeavouring to chew even the softest substance. The lower jaw is seldome attacked with this disease.

It differs likewise from that disorder which has obtained the name of an ague or rheumatism in the face, a disorder as painful

as it is frequent. This, though it is often connected with some decay in the teeth and the nerves that are distributed to them, yet for the most part its exacerbations are regular in respect of time, like the fits of an ague, and at night, as in the rheumatism

(p 182) The toothache, arising from a faulty tooth, does not often indeed afford much remission from pain, till either the inflammation is abated by some means, or the nerve is destroyed, or rendered less sensible

But when to the usual cause of a toothache this rheumatic disposition is conjoined, though the pains are never intirely off, yet the night is the time of their greatest severity. Besides, the season of the toothache and this species of rheumatism is generally from the end of adolescence to the meridian of life, or later

The disease which is the subject of this essay is seldom observed till between forty and fifty, and through the later stages of life. Contrary to what happens in the preceding complaints, the affection I am treating of is most commonly severer in the day than in the night, sometimes, indeed, it is excited to an extreme degree of violence by the lightest touch of the bed-clothes, which can scarcely be avoided in turning, or any other motion in bed

Some painful affections of the head, and which sometimes extend to the face, likewise occur in practice, that arise from ancient venereal complaints imperfectly cured

These likewise, as the rheumatism above mentioned, are always most severe in the night, they come on insensibly about bedtime, they increase till morning, then abate, so as to allow a few hours sleep, and are little felt in the day. The pain is described by the patient to be in (p. 183) the bone itself, as if bored with a gimlet, or some other instrument. From its commencement in the evening till it abates in the morning, it never is entirely off, nor does it shift from one part to another of the head and face, as frequently happens in the rheumatism, besides, a little enquiry generally affords one sufficient grounds to justify the treating of it as a venereal complaint.

One of the first cases I met with was in a widow gentlewoman of about sixty-five years of age, who in general had enjoyed a good

share of health, in easy circumstances, and without any apparent cause of anxiety, or other latent causes of disease

In a moment she would be seized with the most acute excruciating pain, affecting the inner canthus of the eye: it lasted but a few seconds, forced out the tears, and gradually went off In a few minutes the same thing happened, and in like manner at unequal distances during the day, so as to occasion a life of great misery

Its appearance was like that of a severe spasm it had been considered as such, and treated with the most efficacious antispasmodics, but to little purpose, the pain still continued returning in the same manner. Opium in considerable doses was the only medicine that procured relief, but the costiveness it occasioned, with the thirst and headache, almost made her of opinion, that the remedy was not less difficult to bear than the disease. At length, (p. 184) however, it seemed to decline by the use of extract of hemlock, together with her strength, general ill health ensued, and she continued a sufferer by it to her death

As I was often present when these exacerbations happened, it was not difficult to recollect the disease when I met with it in other subjects, several of whom I have seen, and always with concern, as the methods I had pursued for the most part obtained but a temporary relief, till I made use of the extract of hemlock in the case above mentioned Since that time I have had recourse to it whenever the disease occurred, and for the most part with success

One of the last cases I met with, was the most obstinate I had seen. A gentlewoman near fifty, of a full habit, rather strong make, accustomed to plenty, and using much and various exercise, had been seized with a violent pain affecting one side of her head and face, from the upper edge of the temporal muscle down its whole extent, and reaching to the teeth on that side Before I had been in the room two minutes, I suspected, from the violent contortions of the face and the whole body, that her complaint was of the kind I have been describing. Not that these contortions are spasmodic or involuntary, but such as severe pain often occasions, when we endeavour to abate the

sense of pain in one part by a general exertion of force upon some other, or over the whole body Speaking, or chewing, or even slightly touching (p 185) the skin or the side affected with the softest handkerchief, would immediately excite the pain, which, after continuing perhaps a quarter or half a minute, gradually went off, till it was again awakened by some fresh motion. She had been under the care of several persons of eminence in the profession, who had scarcely left any rational methods of relieving her unattempted She had no fever, no other indisposition that pointed out means of relief

The extract of hemlock was ordered, the quantity gradually increased to a full dose, and this was continued almost a month before any considerable amendment was observed. So much relief, however, was obtained as to encourage us to proceed Sometimes, indeed, it returned for a few days with as much violence as ever. Still we persisted. It was almost a year that she persevered in this method, and to her entire satisfaction, as near another year has elapsed without perceiving any intimation of it. She took no other medicine during the use of the extract, except sometimes a gentle laxative when occasion required, nor was her diet altered, only some cautions given to use the lightest, least savoury kinds, and with some restrictions in regard to quantity

In cases of singular difficulty and obstinacy, it is natural for us to be inquisitive into their causes and their nature, unsuccessful experiments sometimes lead the way to instruction, and we ought never to cease investigating the most (p 186) abstruse recesses of nature, nor at the same time forget the narrow limits of our capacity, and the danger of presumption. What therefore I have to offer upon the nature of this disease, is rather submitted to your consideration as matter of farther enquiry, than as opinions sufficiently established

On reviewing the cases I have seen of this disorder, I recollected the subjects were mostly women. That they were for the most part, if not all, past the time of menstruation. That they were generally of a firm and somewhat robust habit, generally with black hair, and not subject to any particular diseases. Most

of them had borne children, and nothing remarkable had occurred about the cessation of the *menses*, in general, rather of a costive habit, and in the middling situations of life

In two of these cases, a small hard tumour in the breast had occasioned some suspicion of a schirrhus, but had never proceeded to give trouble

These appearances, however, excited my attention, and induced me to suspect that the cause of these extreme pains in the face might possibly be of a cancerous nature, the method of cure and other circumstances seem to corroborate the suspicion

The sex, the time of life, two cases where a tendency to this was obvious, as well as the kind of pain, which was sudden, frequent, and (p 187) severe, and as suddenly remitting, were to me farther confirmations

In tracing the history of persons afflicted with cancers not apparently proceeding from external causes, we shall find for the most part they have been afflicted with erratic pains in the limbs, often about the loins, sometimes in the thighs, and other muscular parts. These have commonly been considered by the patients as merely rheumatic, but if we enquire more particularly, we shall find they are very different. They are not always worse in the night than the day. They are not a dull, heavy, aching pain, and continual, but sharp, lancinating, and remittent. They are not much affected by the weather, nor by any obvious causes, and they frequently disappear for some time, at least, there is a considerable abatement in their violence.

These pains do not always cease when the cancer becomes obvious, they are sometimes severe when the disease is making great progress externally and experienced surgeons well know how little benefit the unhappy patients have to expect from removing the breast or other diseased part, if the patients have been long subjected to such complaints.

It seems not improbable, but that a sharp, corrosive, cancerous acrimony may long be pervading, like electrical matter, certain series of vessels, and, when collected in a certain quantity, (p. 188) may create these pains, yet without seizing upon any part with such violence as to destroy its functions. But if a part

that favours its operations is once injured, those we call glandular especially, as the breasts, and the subcutaneous glands in the face, and other parts, if these become incapable of resisting or subduing the cancerous matter that may be thrown upon them, the mischief then becomes evident, and advances in proportion to the combination of those causes which favour its progress. An original disposition to form such acrimony, bad health, anxiety, external injury, and extreme sensibility of pain and danger, seem to constitute a part of these causes

There are few physicians, I believe, who may not, on reviewing many cases which have occurred to them of anomalous pains in different parts of the body, so as sometimes to counterfeit gouty, bilious, and other internal affections of the stomach and bowels, perceive some analogy between them and the complaints here pointed out

Perhaps a cancerous acrimony may have been the basis of some of these stubborn evils, and probably a good deal of mischief might have been prevented by treating them early as if they were known to be of a cancerous complexion, by opening a drain, by repeated small bleedings, by gentle cooling laxatives, the hemlock, a light diet, and the other usual auxiliaries in such complaints (p 189) It is with a view to promote some attention to this object, that I have troubled you with these reflections

P S Since the preceding account was presented to the Society, I have met with two more cases of this painful affection, and found upon inquiry, that in both these there had been hard, permanent, and painful tumours in the breast, that these tumours became less painful when the face was attacked, and that both the one and the other had yielded to the efficacy of this medicine, the pain and the tumour both abating.

THE END.

MEDICAL CLASSICS

Compiled by

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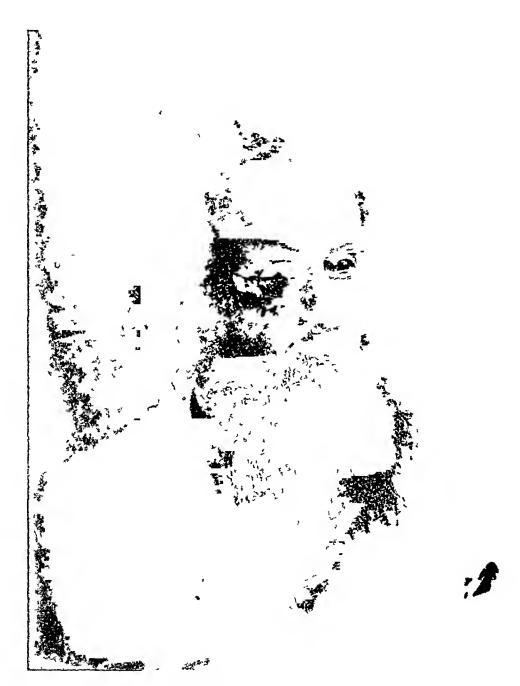
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SIR JONATHAN HUTCHINSON

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Sir Jonathan Hutchinson

BIOGRAPHY

- 1828 Born July 23 in Selby, Yorkshire, England, the second of eight sons of Jonathan Hutchinson and Elizabeth Massey, his wife The family belonged to the Society of Friends and the father was a prosperous "middleman in the flax trade" Educated at home by a Quaker governess
- 1845 Age 17 Apprenticed to Caleb Williams, a Quaker surgeon, who was also a Quaker preacher, in York
- 1846 Age 18 Entered the small school of medicine at York where Dr Williams lec-
- 1849 Age 21 Went to London where he entered St Bartholomew's Hospital for clinical instruction Came under the influence of James Paget and Thomas Wormald Lived quietly and frugally, coached medical students and made a virtue of necessity by praising his diet, a regimen of dried figs and bread (Bruce) Elected President of the Abernethian Society, the students' debating society
- 1850 Age 22 Obtained the License of the Society of Apothecaries and was admitted a member of the Royal College of Surgeons of England Returned to York to act as house surgeon at the County Hospital
- 1851 Age 23 Returned to London and was appointed physician's assistant at the Hospital for Diseases of the Chest in Liverpool Street Attended the practice of the hospitals at Moorfields and Blackfriars to gain more knowledge of diseases of the eye and skin
- 1852 Age 24 Began to contribute "reports" to the Medical Times and Gazette
- 1854 Age 26 Refused to go to the Crimean War because of religious scruples Elected surgeon to the Hospital for Diseases of the Skin and surgeon to the Metropolitan (Free) Hospital
- 1856 Age 28 Married a Quaker girl and had nine children, one of whom, Jonathan, became a widely known surgeon Lived first in Reigate, later in Finsbury Circus, and in 1867 in Cavendish Square
- 1858 Age 30 Described the notched, peg-shaped incisor teeth in congenital syphilis, now known as Hutchinson's teeth
- 1859 Age 31 Surgeon to the London Hospital until 1883 Aided in founding the New Sydenham Society
- 1861 Age 33 Became an important factor in the development of the professional habits of J Hughlings Jackson
- 1862 Age 34 Elected a Fellow of the Royal College of Surgeons of England
- 1863 Age 35 Appointed surgeon to Moorfields Hospital and to the London Hospital Had a special interest in ophthalmology

- 1879 Age 51. Professor of surgery at the Royal College of Surgeons until 1883
- 1882 Age 54 Elected a Fellow of the Royal Society
- 1888 Age 60 Elected president of the Royal College of Surgeons
- 1889 Age 61 Published the first of ten volumes of Archives of Surgery, last one published in 1899, "entirely written by himself, forms a great storehouse of original observations on disease, which will some day be studied like the works of John Hunter" Garrison
- 1891 Age 63 Hunterian Orator to the Royal College of Surgeons
- 1908 Age 80 Honor of Knighthood conferred on him
- 1913 Age 85 Died on June 23 at his house, The Library, Inval, Haslemere He had filled the chair of every important medical society in England, had represented his profession on many Royal Commissions, had been honored by knighthood and by honorary degrees from great universities (Bruce)

Sir Rickman Godlee describes him well when he says "We recall him as a tallish, dark figure, that changed very little from middle life to old age, dark eyes that seemed to look past you through his spectacles, black hair, black beard, lengthening and growing grey with age, a suit of black broadcloth, and a top hat that grudgingly gave place to a wideawake. We see him presiding at our medical meetings and addressing them in precise clear-cut sentences, rather solemn, without much sparkle, but full of meat, and made attractive by more than a trace of Yorkshire accent"

EPONYMS

DISEASE I—degeneration of the choroid, marked by irregular yellow spots around the macula lutea, and believed to be due to an atheromatous state of the arteries. It is seen in advanced life, and is called also choroiditis guttata senilis or Tay's choroiditis.

DISEASE 2—a multiple benign sarcoid characterized by large nodules and reddish papules which disappear, leaving a discolored area, called also Hutchinson-Boeck's disease

FACIES—a peculiar appearance in ophthalmoplegia externa the eyeballs are fixed, the eyebrows raised and the lids drooping

Mask—a sensation as if the skin of the face were compressed by a mask often a symptom of tabes dorsalis

Melanotic Whitlow—subungual melanoma

PATCH—a reddish or salmon-yellow patch of the cornea in syphilitic keratitis

Prurigo—of dentition

Pupil—one dilated on one side of the body or the unequal pupils in meningeal hemorrhage

Sign i—interstitial keratitis and a dull-red discoloration of the cornea in inherited syphilis

Sign 2—notched and narrow-edged permanent incisor teeth regarded as a sign of congenital syphilis but not always of such an origin

Sign 3—or triad interstitial keratitis, notched teeth and otitis occurring together in inherited syphilis

Syndrome—adrenal sarcoma of infants with metastases to the orbit

TEETH—see Sign 2

TRIAD—see Sign 3

Varicella—varicella gangrenosa—a rare form of chicken-pox in which the eruption leads to a gangrenous ulceration also called dermatitis gangrenosa infantum Wart—condyloma of secondary syphilis on the tongue

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1854

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INTRODUCTION

A glance at the list of writings of Jonathan Hutchinson will make the reader wonder how any man could possibly have energy enough to accomplish so much. This man was a naturalist, pathologist, surgeon, ophthalmologist, syphilographer and neurologist; he illustrated well the fact that most men of genius have a wide range of mental powers. They are interested, not superficially, in many things

From his very beginning, Jonathan Hutchinson seems to have been destined to amount to something. He, being a Quaker, was reared with industry and frugality. At 17 he was apprenticed to a surgeon and at 21, he came under the influence of Paget and Wormald at St. Bartholomew's Hospital in London. There he helped support himself by coaching other students. He advanced rapidly but in a characteristic, non-spectacular way to a membership in the Royal College of Surgeons of England, to an assistantship at the Hospital for Diseases of the Chest, to the position of surgeon at the Hospital for Diseases of the Skin and to the Metropolitan Hospital. All this happened before the age of 28

Meanwhile, at the age of 24, Hutchinson began to contribute short reports to the Medical Times and Gazette When he reached his most productive period he published for ten consecutive years an annual volume on surgery, entirely written by himself Such enthusiasm, ambition, knowledge, industry and perseverance are not often encountered

Among Hutchinson's greatest contributions are his description of the notched, peg-shaped incisor teeth in congenital syphilis. His first paper on this subject, Report on the effects of infantile syphilis in marring the development of the teeth, appeared in 1858 and is herein reproduced in its entirety. It contains a plate illustrating the characteristic teeth. Many other papers on this subject followed, these may be found listed in the bibliography

Garrison is authority for the statement that Hutchinson saw over a million cases of congenital syphilis with interstitial keratitis, notched teeth and labyrinthine disease (Hutchinson's triad) Hutchinson's paper On the different forms of inflammation of the eye consequent on inherited syphilis, published in 1860, is completely reprinted in this number of Medical Classics

Hutchinson also described varicella gangrenosa and other skin diseases, the unequal pupils in meningeal hemorrhage, tobacco amblyopia, the relation of gout to diseases of the eye and hemorrhagic retinitis. He wrote on head injuries, diseases of the tongue, amputations, melanosis and intussusception. He was truly, as Bruce has called him, "the last of the multispecialists"

This number of Medical Classics contains the original papers describing Hutchinson's teeth and triad. These writings were of the greatest importance in teaching the medical profession the true nature of the conditions and their relation to hereditary syphilis. These eponyms are well known to every practitioner and medical student of today and are a distinct contribution to medical knowledge



Report on the Effects of Infantile Syphilis in Marring the Development of the Teeth

BY

JONATHAN HUTCHINSON

Transactions of the Pathological Society of London, 9 449-456, 1858

OR a considerable time past, I have been in the habit of recognizing in a certain very peculiar

development of the permanent teeth an indication that their possessor had in infancy suffered from hereditary syphilis A remark to to this effect, which I made at a meeting of the Pathological Society early in its past session, being received with expressions of incredulity, it occurred to me, that it might be well to make public such evidence as I possessed on the subject. With that view, the facts which are the basis of the following report were collected My friend, Mr Coleman, our dentist at the Metropolitan Free Hospital, entered with zeal into the subject, and readily agreed to take casts of the teeth of any patients I should send him (See Mr Coleman's statement, page 453) Most of the cases taken, were those of patients attending at the Royal Ophthalmic Hospital, on account of chronic interstitial keratitis, an affection which is, I believe, almost always a result of inherited syphilis Their ages varied from twentyeight years to five years In all a clear history of syphilis was established, either by the free confession of the patient's parents, or by the account given of symptoms of undoubted character

during infancy With this statement as to the diagnosis I must here content myself, as space will not permit of a recapitulation of the facts, on which, in each case, it was founded The number of casts (p 450) taken was thirteen,* and in all instances, a stereographic portrait of the patient was also secured, which in many instances, illustrates very well the peculiar physiognomy impressed by the disease During the six months in which we were especially engaged in this inquiry, at least double the number of cases mentioned passed under our observation, but it was not deemed needful to take casts of all I may here remark, that cases in which young adults display indubitable marks of having suffered from infantile syphilis, and in which also a clear history is obtainable, are very infrequent in the practice of general surgery Had it not been for the field offered by the Ophthalmic Hospital in connection with the form of keratitis above adverted to, I should not have been able to collect in the alloted time a tenth of the cases. With these remarks as to the nature of the evidence, I will now pass to the conclusions arrived at

That there is a peculiar condition of the teeth, which results from the influence of hereditary syphilis, and that the most frequent features of this condition are the following —a Smallness —The teeth stand apart with interspaces, and are rounded and peggy in form instead of flat b Notching They usually exhibit in their border a broad shallow notch, or at times, two or three (serrated) Owing to their softness, these teeth rapidly wear away, and this notching is thus often obliterated, but when markedly present, it is one of the most decisive conditions Instead of the clear, smooth, white exterior of good teeth, they present a dirty greyish surface, totally destitute of polish and rarely smooth No amount of cleaning will materially alter this feature which owes its existence, I believe, to the great deficiency of enamel. e Wearing down As before observed their softness from deficiency of enamel renders them liable to premature wearing down. The teeth of a syphilitic patient not twenty, will often be ground down as much as those of a very old person

^{*}Twelve casts and fifteen stereographs were brought before the Society The plate represents a well-marked example of malformed teeth from a photograph

should be, and this in cases in which there is no peculiarity as to position, such as the front teeth meeting in the bite. An unusual degree of wearing down if co-existent with other peculiarities is then a (p 451) suspicious condition. f The signs mentioned apply almost exclusively to the incisiors and canines, and in fact the grinders are usually altered in a very much less degree Their surfaces are often more uneven than those of healthy teeth, and now and then they present tubercular projections of very peculiar character.

These conditions are totally distinct from those produced by the ravages of caries. Very often the mouth of an hereditarily-syphilitic patient will present a full set of teeth, quite free from decay, but all of them marked with features of unmistakable peculiarity. As a general rule, however, they are very liable to caries. Of course, it is only when several of the conditions enumerated exist together, that a confident opinion can be given, and then it is the regularity of the type, and the fact that it marks all the front teeth in both jaws, which offers the best means of distinguishing it from other forms of disease or irregularity

The above remarks apply only to the permanent set. The milk-teeth of syphilitic-infants, are liable to exfoliate before being cut, and after having been cut, are often of small size, bad colour, and very liable to decay, but the notching and the peg-like form are rarely noticed. I have no doubt that the explanation of the fact that they suffer less uniformly than the permanent set, and in a somewhat different way, is to be found in the fact, that at the time of the original stomatitis, they are already well-formed, whilst the others existed only as soft pulps It is, I am convinced, to the occurrence of syphilitic stomatitis during the first few weeks of life, and its complication with alveolar periostitis, that the marring of the teeth is to be attributed. A patient may be syphilitic, but if in infancy he escape stomatitis, his teeth will not be damaged

In demonstration that during the syphilitic stomatitis, so common in the infantile form of the disease, inflammation of the alveolar periosteum, and the tooth-pulps does actually occur, I may here mention the particulars of two cases, specimens from which were brought before the Society at a former meeting.

In the first of these, an infant aged one month, came under my care at the Metropolitan Free Hospital, in November, 1856, on account of sore mouth. I observed the edge of a central incisor, (p 452) projecting from the spongy and swollen gum On touching it with a probe, it fell out, a mere tooth crown, without any fang whatever, and a few drops of thick pus followed. During the next three months, four other teeth exfoliated from the same side, all fangless, and finally a considerable portion of the alveolar process and outer lamella of the jaw came away. The gum then became sound The mother in this case was known to have had syphilis I have frequently, since the teeth came away, seen the infant for relapses of syphilitic eruption

The subject of the second case, was a female infant, aet 7, who came under my observation at the Royal Ophthalmic Hospital, being a patient of Mr Critchett Her cachexia was extreme, she had suffered snuffles, and double purulent ophthalmia. The history given was, that she had been quite healthy at the time of birth, and that the symptoms had set in on the fifth day. Her mother had sores at the corners of the mouth, which were of an unmistakably syphilitic character. In this case, four teeth came away, all of them, as in the former case, mere crowns, and of a dirty colour. Suppuration attended the process of exfoliation.

These cases, it must be borne in mind, are quite distinct from examples of premature decay of teeth. The teeth had never been cut, and were thrown off by inflammation beneath them, no caries whatever existing. They are, I believe, of very infrequent occurrence, the alveolar periostitis of hereditary syphilis rarely proceeding so far as to cause either suppuration or death of the tooth crowns. They are of much interest, however, as examples of the extreme effects of the same morbid process by (p 453) which, I believe, that the malformation of the permanent set, to which I have alluded, is caused

Mr Coleman was good enough, at my request, to preserve notes of his examination of the cases which I sent him, and

as these were taken quite independently of my own, I may here suitably introduce his summary of them. It will be seen that we coincide in all important particulars

Mr Coleman states as follows—"The following appears to be the most important peculiarities in the teeth of the patients I examined—

- I "The period of the first dentition —Although the time of cutting the first teeth varies considerably, yet from the calculations of writers upon the subject, it appears that the central incisors may be looked for about seven months after birth. In eleven of these cases where information could be obtained, two had their teeth at birth, one when a few weeks old, two about two months after birth, two about the usual time, the remainder very late
- 2 "The form of the teeth They are universally small, for although the alveolar arches are decidedly below the average size, they are in most considerable spaces between the teeth, they are also more round in form, resembling little pegs, projecting from the gum. The central incisors of most have a deep notch in their cutting edges, giving this portion of the tooth a tuberculated appearance. In many cases the teeth are much worn from mastication, the enamel being very soft, and probably containing a smaller proportion of calcareous salts than the normal quantity, from this circumstance the notch is not so marked in some cases, though its commencement may be observed

"In nearly every case there is a deficiency in the superior alveolar arch, at the anterior portion, so great in some patients, that the upper and lower incisors are a considerable distance from each other when the mouth is shut. The notched appearance in these being well marked, and the teeth not having been worn by mastication.

"Teeth (incisors) having a notched appearance, are not very uncommon, but they are rarely so marked as with these patients. The upper central incisors also, instead of having their internal or mesial borders slightly everted, as in every well-developed arch, have them slightly inverted towards the palate.

(p 454) 3 "Colour — This is very characteristic, being of a dirty, translucent shade, not, perhaps, unlike the size frequently

seen in the oil shops, and therefore somewhat difficult to describe, but when once seen readily recognized again "

There remains two or three questions to which it may be well to attempt as explicit answers as the subject permits of before closing these observations

- 1. May not the condition of the teeth described, result from other influences beside syphilis?—I have no doubt that any form of stomatitis in infancy in which the periosteum and investing membrane of the teeth became involved, could produce the same imperfections of development. Very probably many of the irregularities in the form, etc., of the teeth are due to the administration of mercurial courses in early infancy As far, however, as my own observation has gone, I believe it is very rare for any other form of stomatitis to produce such a regular type of deviation from what is normal in size, form, and colour, as is seen in good examples of that due to syphilis. In not a few cases where the characters were well-marked, I have formed, from the teeth only, a very decided opinion as to the antecedents of the patient, and inquiry has hitherto always confirmed it large majority of instances, of course such certainty is not warranted, the peculiarities not being so characteristic, and being calculated rather to excite suspicion than to remove all doubt.
- of malformed teeth is observed, may it not be more reasonably attributed to the influence of mercury given to counteract the disease than to the disease itself?—Undoubtedly in a majority of the cases upon which this report is founded, the nature of the disease had been correctly diagnosed by the medical men who had had charge of the patients in infancy. It is but fair, therefore, in these to suppose that mercurial treatment had been adopted, and as regards the teeth, it is impossible to discriminate between what may have been caused by the remedy and what by the disease. I have notes, however, of several cases in which no such diagnosis had ever been formed, and in which, as far as could be learned from the mother, no mercury had ever been given, and in these the state of the teeth was as marked as in any. No one

will doubt (p 455) that a severe form of inflammation of the mouth does occur in syphilitic infants who have never taken a particle of mercury, and it is well known that this condition will usually rapidly subside under the use of that drug In neither of the cases of exfoliation of the teeth above quoted, had any mercury been given I am disposed, therefore, to think that this drug instead of causing, tends to diminish the dental malformation under notice, a conclusion which is strengthened by the circumstance that I have never yet seen the teeth in a condition which resembled at all closely the syphilitic type in which the history was that mercury had been given for non-specific disease in infancy

3. Do the subjects of inherited syphilis always present dwarfed and ill-formed teeth?—Undoubtedly not. I fear that those who do so are only a small minority of the class. As already observed, it is, I believe, essential to this condition, that the patients shall not merely have inherited a taint, but that they shall have suffered severely in infancy from consequent inflammation of the mouth. The infants who do suffer are, we know, but a small proportion of those whose fluids are yet in greater or less degree tainted by specific disease. In many cases I have noticed the almost entire exemption from symptoms of several infants in a family, whilst one of them had a most violent outbreak, and in two or three cases of especial interest in this respect, one twin suffered whilst its fellow escaped

In conclusion, I may remark that the state of the teeth is often of great use in enabling us to decide whether certain other symptoms presented by adult patients are the results of hereditary or of acquired syphilis. It is of course impossible for acquired disease in any way to alter the form or size of the teeth. In two or three instances in which patients between the ages of twenty and thirty came under care, presenting the sunken nose, fissured lips and earthy complexion characteristic of syphilis, I was enabled by a glance at the teeth to determine at once that these were in all probability due to congenital, and not to acquired disease

Mr. Jonathan Hutchinson, 18th of May, 1858

A Committee was appointed to examine Mr Hutchinson's cases and reported as follows —

"Mr Hutchinson afforded the Committee an opportunity of carefully examining six patients, whose teeth presented certain marked structural and other peculiarities enumerated by Mr Hutchinson at the last meeting of the Pathological Society, in May, 1858



Portrait (from Stereograph) shewing the Dwarfed and Notched Condition of the Permanent Teeth in Hereditary Syphilis

"The Committee consider that the previous existence of syphilis was substantiated in five out of the six cases examined by them, and that the sixth case was probably of the same character

"The Committee are disposed to conclude that the relation of cause and effect sought to be made out by Mr Hutchinson is sustained by a careful examination of the cases referred to, but they hesitate to express a more decided opinion on the number of

cases submitted to them Mr Hutchinson desires to offer further cases for examination, and the Committee, feeling the importance of the subject, have determined to meet again, and obtain this additional evidence on the subject "

Graily Hewitt, Henry Lee, Henry Thompson, 14th of July, 1858



On the Different Forms of Inflammation of the Eye Consequent on Inherited Syphilis

BY

MR JONATHAN HUTCHINSON

Published in Royal London Ophthalmic Hospital Reports, 1 191-203, 226-244, 1858, 2 54-105, 1859, 258-283, 1860

Y OBJECTS in the following essay are—I To give a more detailed account, than has yet been attempted, of the form of acute iritis, occasionally met with in syphilitic infants (p 192) II. To shew that acute iritis is a consequence of hereditary syphilis is not so very rare as it has been thought, and that it now and then occurs at periods subsequent to infancy.

- III To endeavour to prove that the form of kerato-iritis met with in young persons, and formerly known as "aquocapsulitis," is, in the majority of instances, of specific origin
- IV To endeavour to prove that the disease known as "Chronic corneitis," "Interstitial corneitis," "Strumous corneitis," is almost always a direct result of inherited syphilis
 - V To illustrate the connexion with hereditary taint, of some of the cases of deposit in or upon the retina or choroid, hitherto classed as "scrofulous"

VI. To shew that certain cases of tinea tarsi, fistula, lachrymalis, and other affections of the ocular appendages occurring in children are of syphilitic origin

My attention was first drawn to the dependence of certain inflammations of the eye in infants and young persons upon hereditary syphilis about eight years ago Investigation early led me to the belief that the term "strumous" is applied to several which ought properly to be called syphilitic To enable me, however, to put this belief on such a basis as should entitle me to ask for it the assent of others, a large collection of facts was requisite. To have collected these would have taken me far longer than it has done, had I not received the kind assistance of many friends Only a few of the cases which will be found recorded in the following report occurred in my own practice. From visiting many hospitals I have had unusually good opportunities for getting together a series of examples of diseases, which are certainly rare For permission to make use of cases observed in their wards, I am especially indebted to Mr Dixon, Mr. Critchett, and Mr. Bowman, of the Moorfields Hospital, to Mr Lawrence and Mr Wormald, of St Bartholomew's, (p 193) to Mr Startin, of the Hospital for Diseases of the Skin, and to Dr Risdon Bennett, of the Victoria Park Hospital To this explanation I must also add a few words of apology for the length of the present essay. The profession very properly receives wide assertions respecting the direct dependance of disease upon inherited taint with much Peculiar difficulties, moreover, beset the attempt to prove anything respecting the remote effects of venereal disease To those who appreciate the great difference in value of a principle made probable by evidence and one merely asserted, the above considerations will, I trust, be a sufficient apology for what might otherwise appear prolixity

ACUTE IRITIS DEPENDENT UPON HEREDITARY SYPHILIS

This affection was first described in connexion with its true cause by Mr Lawrence, and it is, I believe, the only inflammation of the eye which has hitherto been recognised as dependant on

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inherited syphilis Since Mr Lawrence's notice of it, cases have been recorded by Dr Jacob, by Maunsell and Evanson, Mr. Walker, and Mr Dixon The latter gentleman especially has given an excellent account of its peculiar features. I can, however, find but six cases on record, and, as my own experience supplies but ten others, it will be necessary to cite the whole in order to obtain sufficient data for trustworthy inferences. Of previously published cases a short abstract will be enough. To commence then with the earliest we will take first the one recorded by Mr. Lawrence.¹

Case I —Iritis of but one eye occurring in a syphilitic infant

Jane M, aged 16 months Acute iritis of the left eye commenced at the age of 15 months. The iris lost its brilliancy and assumed a dark tint. The pupil was a little contracted, and there was some intolerance of light. There was (p. 194) some sclerotic redness, and also the upper lid was slightly swollen. The infant had at the same time a vaginal discharge and flat condylomata about the anus and on the perineum. Its mother had contracted syphilis three months prior to her confinement. The infant, healthy at birth, was stated to have had afterwards purulent ophthalmia and an eruption on the skin. Mr Lawrence employed a mild mercurial treatment, and states that the eye recovered completely. It must be noted as perhaps accounting for the unusually delayed appearance of the iritis, that the infant probably contracted the taint only very shortly before birth

Case II —Iritis of but one eye in a syphilic infant

An infant, aged II months, of whose antecedents nothing more is stated than that its father had at the time a syphilitic tubercular eruption "Well marked iritis" occurred in one eye No details are given This appears to have been the only example of the disease which had come under the notice of the writers (Maunsell and Evanson).²

¹ Treatise on Venereal Diseases of the Eye, 1830, p 306

² Practical Treatise on the Management and Diseases of Children, 1847, p 534

Case III.—Pupil obliterated by iritis in a syphilitic infant.3

In this case the child did not come under Dr Jacob's care until about three years after the inflammation. It then presented a soft condylomatous elevation at the anus, and numerous small fissures and clefts in the tongue. The diagnosis of syphilis was clear. No suspicion had, however, been entertained as to the true nature of the case previously, and the child was brought to Dr Jacob to be cured of supposed cataract. On examination of the eye "the pupil was found contracted and adherent to an opaque lens and capsule. Vision was irreparably lost." The other symptoms disappeared under the mercurial treatment which Dr Jacob adopted. The inflammation of the eye was stated to have occurred at the age of "a few months."

(p. 195) Case IV.—Iritis of one eye in a syphilitic infant 4

Mary O, aged 6 months, had been, when six weeks old, the subject of a copper-coloured rash on the hands and legs. It had been partially cured by medicine, but enough still remained to identify it. At the age of five months the right eye was inflamed. The iris became muddy, and showed three or four whitish masses of lymph on its surface. The pupil was all but motionless, the conjunctiva and sclerotic were much congested, and the cornea hazy. After a fortnight's mercurial treatment both the iritis and the rash "had almost wholly disappeared." The attack of iritis had lasted altogether about six weeks

The next two cases are from Mr Dixon's work, and were under that gentleman's care at the Moorfields Ophthalmic Hospital

Case V 5—Iritis of one eye in a syphilitic infant—Deposit of lymph on the capsule of the lens in the other eye—Recovery of both. Mary Ann W, aged 3 months Healthy when born, but at the age of seven weeks had a scaly syphilitic eruption. The iritis had set in in the ninth week, and the acute stage had passed

² Treatise on Inflammations of the Eyeball, 1849, p 97

Provincial Medical and Surgical Journal, 1845, p 293

⁵ On Diseases of the Eye, p 149

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by, when, three weeks later, the child was placed under Mr. Dixon's care The accompanying symptoms were loss of the eyelashes, aphthae in the mouth, scaly eruption on the face, copper-coloured patches on the belly and thighs, and desquamation of the cuticle in different parts Although both parents denied syphilis, yet the real nature of the disease was beyond doubt It appeared that there had never been much congestion of the tunics of the eyes, the earliest symptom noticed by the mother having been "a pearly appearance in each pupil" The left iris was dotted over with grains of lymph, its pupil contracted and adherent (p 196) The right iris was clear, but on the capsule of the lens was a crescentic patch of effused lymph. Under a three months' steady employment of small doses of mercury, every trace of deposit disappeared in both eyes use of mercury in effecting the removal of lymph, which had evidently been some time effused, was very conclusively marked

Case VI 6—Double iritis in a healthy-looking infant, but with a clear history of hereditary syphilis—Permanent occlusion of one pupil

William J. J., aged 4 months Healthy when born, but when a month old had a dusky red eruption over the body, which disappeared under mercurial treatment. His mother owned to having had sores, followed by secondary symptoms, a few weeks before her pregnancy. When admitted under Mr. Dixon's care, the right eye only was affected The child was then healthy, well grown, and lively, and displayed no other symptoms of syphilis There was, however, "a certain dusky tinge of the skin," which disappeared under the subsequent treatment. The intis had existed only a week, and at first the mother had noticed the white of the eye to look "pinkish." All sclerotic congestion had, however, passed away at the time of admission: the cornea was quite clear, but the lower half of the anterior chamber was occupied by pale yellow lymph. The pupil was misshapen, but the upper half of the iris was clear. Five days later, the eye

⁶ Op cit, p 145

was much worse, the iris being discoloured, and much additional lymph effused The left iris was also slightly inflamed Mercury was now commenced, and in about a month the effused lymph had been absorbed The pupil of the right eye was, however, permanently occluded In the left the restoration was perfect

The above six cases are all the examples of syphilitic iritis in infants I have been able to find recorded The (p 197) following are those which have fallen under my own observation—

Case VII —Double iritis in a syphilitic infant—Recovery of both eyes

Harriet H, aged 8 months, an illegitimate infant, was brought by her mother to the Hospital for Skin Diseases in July, 1852. She was wasted and cachectic, and about the anus were excorated condylomata. there were also ulcerated fissures extending upon Her mother was covered with syphilitic rash the alae nası was stated that, when a few weeks old, the child was affected by severe snuffles, after which double otorrhoea and a rash on the nates occurred The right eye only was affected at first anterior chambers contained much brownish lymph, and the iris, where visible, was muddy and discoloured There was a very faint sclerotic zone, and no intolerance of light. treatment was at once adopted, and the lymph was slowly absorbed The mother attended irregularly, and two months later a slight attack occurred in the infant's left eye Four months from the date of admission all lymph had been absorbed from both eyes, excepting that some slender adhesions of the pupillary margin remained in the right. The complete though slow absorption of so large a quantity of lymph was a result very encouraging to the long-continued use of mercury in similar states.

Case VIII —Iritis in one eye in a syphilitic infant—Result not known

Emily C, aged 3 months, attended in the out-patient's room at St Bartholomew's Hospital, under the care of Mr Wormald, in the summer of 1852 Her mother denied having had sores or

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other suspicious symptoms, but she had, she said, greatly lost her health since marriage, and had had one miscarriage. This was her first living infant. The child was stated to have been healthy when born, and to have (p. 198) remained so until aged two months, when there appeared almost simultaneously an eruption of psoriasis on the face, patches of erythema marginatum about the thighs and body, aphthae in the mouth, snuffles and emaciation. Quickly following on these was inflammation of the left eye. The irritis had existed about a month when first brought under notice. The pupil was then irregular, fixed, and partially occluded by lymph. The irris was discoloured. There was no sclerotic congestion. A mercurial course was commenced, but the mother did not attend, and I am, therefore, unable to state the result.

Case IX.—Slight iritis in a syphilitic infant who had been some months under treatment—Perfect recovery of the eye.

Christopher T, aged 8 months, had been attending for four months, under Mr. Startin's care at the Hospital for Skin Diseases, on account of syphilitic rash, etc., before the iritis shewed itself Mercurials had been ordered, but the attendance had been very irregular. His mother had also been under treatment for the same disease. This was her first living child. When born he was stated to have been healthy, but at two weeks old unmistakeable symptoms shewed themselves. They consisted in papular rash over the whole body, snuffles, and muco-purulent ophthalmia. All these were nearly well when the iritis supervened. A zone of sclerotic redness was present during the first four days of the attack, but afterwards wholly disappeared The iris became muddy, and of a sea-green hue, but there was no great effusion of lymph upon its surface The mercurial treatment, which had been disused, was resumed, and in the course of a fortnight the iris was perfectly clear.

Case X—Iritis in one eye in a syphilitic infant—No treatment— Permanent occlusion of the pupil.

Sarah P, aged 8 months, a pallid puny infant, was admitted

under Mr. Wormald's care at St Bartholomew's Hospital, on April 20th, 1855 Her mother had lost five (p 199) infants with suspicious symptoms, and this was her only one living. She was stated to have appeared quite healthy at the time of birth, but had begun to suffer from snuffles and rash on the skin when a fortnight old. There was a copious eruption of psoriasis on the body, a crop of condylomata around the anus, and the peculiar odour of hereditary syphilis was very distinct. The right eye only had suffered. Its pupil was wholly occluded by a large deposit of reddish lymph, which had become organised. The cornea was unduly prominent. The disease had existed for some months, and no treatment had as yet been adopted. Unless restored at some future time by an operation for artificial pupil vision was totally lost.

Case XI.—Slight double iritis in a syphilitic infant—Result not known

Alice Kate C, aged 2 months, was admitted under Mr Critchett's care at the Moorfields Hospital, on September 25th, 1855 Her mother had borne eight children, of whom this was the only one surviving Six of the others had been stilborn, and one had died with well marked syphilitic symptoms The patient was, according to report, and as is quite usual, of fair skin and very healthy aspect at the time of birth When a week old, psoriasis of the palms and soles was noticed, and shortly afterwards general psoriasis and severe snuffles. She was now a cachectic puny baby The psoriasis for an infant was unusually well marked, the patches being thickly crusted with shining white scales, it was also very symmetrical The skin of the palms and soles was peeling, all the lids were affected by tinea tarsi, and both irides, which were stated to have been blue, had assumed a sea-green colour Both pupils were notched at their margins and had slender films of lymph attached to them, but there was no visible deposit of lymph on either iridal surface A delicate pink zone was perceptible in each sclerotic when looked for, but might have easily escaped notice A mercurial treatment was commenced, but the irregularity of the mother's (p 200)

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attendance prevented me from becoming acquainted with the result of the case.

Case XII—Iritis of one eye in a syphilitic infant—Anterior chamber wholly occupied by lymph—Result not known.

Anna L., an infant Jewess, aged 3 months, was admitted under Mr Critchett's care at the Moorfields Hospital Her mother denied having ever had venereal disease. Both her previous infants had, however, died, and she herself had fissures at the angles of the mouth of very suspicious aspect. Healthy at the time of birth, the infant was stated to have begun to snuffle on the third day, and it was now puny and wasted, with fissures at the corners of the mouth, and psoriasis over the arms, hands, and fingers. The right eye only was affected, and had been inflamed for one month. The sclerotic zone was now faint, but the pupil was wholly obliterated and the cornea rendered opaque by a mass of lymph which adhered to it and occupied the anterior chamber, the lids were inflamed. Mercurial treatment was commenced, but I lost sight of the case and have no further note of its progress.

Case XIII.—Iritis of one eye in an infant, believed to be syphilitic—Permanent occlusion of the pupil.

Emily W., aged I year, came under notice amongst Mr. Critchett's out-patients at Moorfields. Her mother denied having ever had any form of venereal disease. She had borne seven children, of whom three only were living, all the last five had been born prematurely. Several had, she said, suffered in infancy from severe and protracted snuffles, but beyond this all suspicious symptoms were denied. The infant herself was stated to have had a sore mouth and sore anus when a few weeks old; she had never thriven, and, to use her mother's expression, "was still as much of a baby as at the time of birth"; she was a little, puny infant, and the bridge of her nose was much expanded, but she presented no positive symptoms beyond the iritis. The right eye alone was inflamed, and two months had elapsed since the commencement (p 201) of the attack, during which no treatment had been adopted. The pupil was occluded by redish

yellow lymph, which appeared vascular and organised, and did not look at all as if likely to be absorbed. There was no material sclerotic redness. Mercurial treatment (inunction) was prescribed, and, contrary to expectation, in about two months absorption was so far complete that only a thin white membrane remained. The child had both grown and greatly improved in health during the treatment. It is intended shortly to perform an operation for artificial pupil on the occluded eye.

Case XIV—Iritis of one eye in a syphilitic infant—The other eye attacked eight months afterwards—Permanent occlusion of one pupil and much damage to the other eye

The subject of this case was a girl aged 2, to whom my attention was called by my friend Mr Wormald at St Bartholomew's Hospital The left eye had first inflamed at the age of sixteen months, the attack being a pure iritis without any affection of the cornea, much lymph was effused, but the sclerotic congestion was but slight Mr Wormald ordered mercury, and under its influence most of the lymph was removed, leaving the pupil, however, permanently occluded The treatment was pursued very irregularly, owing to the child's parents living in the country After having ceased to attend for about six months she was admitted for a second time, on account of iritis of the right eye, with acute inflammation of the cornea, and a central ulcer which threatened perforation

Unfortunately, I have preserved no note of the other syphilitic symptoms presented by the child, I know, however, that they were unmistakeable Mr Lawrence as well as Mr Wormald saw the case and coincided in the diagnosis. The mother confessed to having had syphilis, and if I remember right, had been herself treated by Mr Wormald for constitutional symptoms. When I last saw the case, the inflammation was subsiding under specific treatment. It appeared certain, however, that the eye would be permanently much damaged

(p 202) Case XV—Initis of both eyes in a syphilitic infant— Permanent occlusion of the left pupil—Operation for artificial pupil James C, of Irish parents, aged 4 months (This case as well as cases 12, 13, and 16, were amongst those under Mr. Critchett's care, at the Moorfields Hospital, but were, through that gentleman's courtesy, transferred to me) He was when born, to all appearance, a healthy infant, but at the age of one month began to snuffle badly, and was soon afterwards the subject of a scaly rash After this the mouth and anus became very sore, iritis set in when he was two months old, and began in the left eye

My note, on December 29, 1857, states "The boy still looks fairly healthy, but has bad snuffles and the remains of a rash The left eye has been noticed to be inflamed for two months and was formerly "bloodshot" At present there is no sclerotic zone, but the pupil is occupied by a white film, and in the outer part of the anterior chamber is a large irregular mass of yellow lymph The lymph is adherent to the cornea but the latter structure is not in itself involved The mother is not aware that the right eye has ever been inflamed, but on inspection its pupil is seen to be irregular from adhesions, and the iris is decidedly dull" treatment adopted consisted in mercurial inunction and was effective in procuring the absorption of all the lymph, excepting that occupying the pupil itself. He improved greatly in health, grew rapidly, and got fat On June 7, the eye having been quite quiet for four months past and the process of absorption being evidently quite at a stand still, I determined, with Mr. Critchett's concurrence, to attempt the removal of the occluding membrane Our decision against any longer waiting was chiefly grounded on the fact, that the eye was already beginning to assume those oscillatory movements so common in the eyes of young children when perception of light is lost. The occluding membrane was evidently very tough and thick, it was feared that unless light could be let in, the globe would (p 203) not develop The operation was accomplished by the simultaneous use of a cutting needle and Leur's forceps, introduced from opposite sides of the The opaque material, which was exceedingly tough, was seized by the forceps and then cut free at its margins by the A good clear pupil was thus gained for the time The subsequent effusion of lymph will, however, necessitate recourse to the needle again at some future time

Case XVI —Slight iritis of one eye in a syphilitic infant—Recovery of the eye, though with some adhesions

Wm John J, aged 9 weeks Healthy when born, and remained so, according to his mother's account, until six weeks old, when he had 'small-pox', after this his eyes inflamed the so-called small-pox not a single scar now remains, but the buttocks are covered with syphilitic eczema and ulcerated condylomata surround the anus He has also snuffles looks ill and has an eruption of psoriasis During the first week of pregnancy she had, she states, much soreness and pain in micturition and a bad discharge, after this her hair fell off, she has been liable also to cracks at the angles of the mouth "not aware that she has had any venereal disease, and has never been treated for such " The iritis in this instance was of the left eye only, and there was so little either of effused lymph or of sclerotic congestion, that several of those present were inclined to doubt my diagnosis The use of atropine, however, removed all incredulity and left the pupil oblique and deeply notched in several directions It was the peculiar green tint of the iris which had led me to believe that it had been inflamed. All acute symptoms had evidently subsided The lids were swollen, and there was some mucous discharge Mercurial inunction was ordered and the infant got rid of its rash. The iris also, to a considerable extent, regained its normal colour and brilliancy. The adhesions, or most of them, still remained at the time the child was last seen

(p 226) I have now concluded those cases of iritis in infants in which the history is sufficiently definite and detailed to allow of their being used in a numerical investigation

SUMMARY OF THE SIXTEEN CASES

- I Age The average age of the patients at the time the iritis commenced was five months and a half The oldest were sixteen months (Cases I and I4), the youngest six weeks (Cases II and I6).
- 2 Sex Four of the infants were males and ten females, the sex of the other two is not specified

- 3 Eye attacked In Cases 3 and 4 there is no statement as to which eye suffered, but in both it was one only Of the others, both eyes were affected in six, the right only in five, and the left only in three We have, therefore, ten cases in which but one and six in which both suffered It is quite possible, however, that in some of the cases recorded as single, a transitory inflammation of the other eye had occurred before the patient came under observation
- 4 Phenomena of the attack. a Congestion of tunics, etc pink zone of sclerotic congestion appears to have been well marked in only two instances, in eight others it was present, but only faint and ill-characterized in one case no note on this point is recorded, but in one it is expressly stated that, during the acute stage of the iritis, there was no increased (p 227) vascularity of the tunics In four cases the acute stage had wholly subsided when the patient came under observation but three cases does it appear that any redness of the eyelids was noticed b. Effusion of lymph If in those cases seen late, or in which the pupil was wholly occluded, it is fair to assume that there had been free effusion, we have nine cases in which the pouring out of lymph may be said to have been copious the others, in three it was moderate, in four the iris was merely tumid and discoloured, whilst in one we have no note as to its state c Keratitic complication In one case the cornea is described as "hazy", in one it ulcerated without any diffused haziness, in one it became prominent without haziness, and in one lymph effused into the anterior chamber became adherent to its posterior surface, its proper structure being unimpaired all the other cases (thirteen eyes) the cornia remained perfectly clear throughout the attack
- 5 Result to the organ In six cases (eight eyes) the cure may be said to have been complete, every trace of lymph having been removed, in two other cases it was complete, excepting that slender adhesions remained In three cases (four eyes) the result is not known. In eight cases one pupil was permanently occluded by organized false membrane. In nearly the whole of the last cases, in which the effusion was never absorbed, the

patients came under care only at a late period of the disease, after the lymph had become organized and but very little chance of its removal remained. To Cases 7 and 13, we may point as interesting illustrations of the efficiency of mercurials in procuring the removal of lymph which already appeared to be vascular, and the absorption of which was by no means expected

- 6 Other symptoms of syphilis present at the time of the iritis In several of the cases the account of coexistent symptoms is either wholly wanting or very imperfect. The specific cachexia is stated to have been present in ten instances, and its having been absent is specially noted in three Psoriasis of the general surface was present in six instances. (p 228) a papular rash in two, psoriasis palmaris in one, erythema marginatum in two, and "peeling of the skin" in one. In one mucous ophthalmia attended the iritis, in one the eye-lashes had all fallen out, and in one the lids were affected by tinea tarsi "Snuffles" in the nose existed as a marked symptom in seven cases, in three there were aphthae or other sores in the mouth, in four soft condylomata around the anus were present, and vaginal discharge in In two cases (5 and 15) the notes show, that although from the history there could be no doubt as to the diagnosis, yet that no specific symptoms existed in the infant at the time of the iritic outbreak
- 7 Length of period which had elapsed between the date of the primary disease in the contaminating parent and the birth of the infected child. Our data on this point are far from being complete. Indeed from the very nature of the inquiry it is impossible that they should. It is, however, of too much importance to be avoided altogether. In one instance the mother had, it appeared, had primary syphilis only three months before the infant's birth, and in another the period was six months. In three cases it seemed probable that a period somewhat less than a year had elapsed, whilst in five it had been at least two years. In two, judging by the fact that the mother had borne a number of children, some of whom had showed suspicious symptoms, the date of the original disease in the father could not be placed nearer than six or seven years. Of the eight cases in which alone a

history of the family is recorded, we find that the affected infant was the only living child of his parents in seven instances. In one, he was the result of his mother's first conception, in three, miscarriages only had preceded his birth, and in three other cases (2, 5 and 7), previous conceptions had terminated either in abortions, or in the birth of children who had died of syphilis. In the only case in the whole series in which it is stated that there were other living children the mother had lost four out of seven live births. These facts, although confessedly meagre, seem to point to the conclusion that the (p. 229) occurrence of syphilitic iritis in an infant indicates the existence in its parents of a form of the diathesis very fatal to the life of the offspring

Respecting the frequency of iritis in infants, there can be no difficulty in admitting that it is amongst the rarest of the symptoms of hereditary syphilis I am sure, however, that it often escapes notice The absence of the sclerotic zone, and the very small amount of local symptoms which it causes, taken with the fact that infants usually keep their eyes shut, will account for In proof of it, I may mention that, in 1852, I showed to a friend of mine, who had then for fifteen years held a surgical appointment, which brought under his notice vast numbers of the poor, the first case of syphilitic iritis in an infant which he had seen. The disease was new to him, and he was much interested in it. Since then he has had, in exactly the same field of observation, no fewer than five cases. Yet in proof, that, however carefully looked for, it is really very rare I may mention, that during the four years' practice at the Metropolitan Free Hospital I have never treated a single case, although numbers of congenitosyphilitic patients present themselves, and I have scrupulously looked at the eyes in all

Reserving for the conclusion of this paper any further remarks upon iritis, I will now pass to the consideration of syphilitic inflammation as it affects other textures of the eye

CHRONIC INTERSTITIAL KERATITIS

This form of keratitis, respecting which I hope to be able to sustain the proposition that it is almost always a direct result of

inherited syphilis is a well-marked disease, the individuality of which has long been recognized In Dr. Mackenzie's excellent work he devotes a section to it under the name of "Scrofulous Corneitis," and states that "it is specifically (p 230) different from every other ophthalmia" Dr Jacob, in his "Inflammations of the Eyeball," gives a description of it which, as with all that comes from his pen, bears the stamp of careful observation, and more recently, Mr Dixon, in his work on "Diseases of the Eye," and Mr Critchett, in his published Clinical Lectures, have devoted special attention to it The manner in which, by interstitial deposit, the cornea is made to assume the appearance of ground glass; the absence of ulceration, and of any tendency to pustules; the comparatively small amount of sclerotic or conjunctival congestion,—are facts in its history as to which all observers agree Nor is the testimony of writers much less unanimous as to its being hardly ever met with except between the ages of five and eighteen,—as to its almost invariably affecting first one eye and then the other,—as to its being of exceedingly slow progress,—or, lastly, as to the fact that the ultimate result is almost always much better than could have been hoped for, judging from the condition of the cornea in its early stages I may here premise that to those whose field of observation does not include a special hospital it is a very rare disease gauge of its infrequency, I may mention that at the Metropolitan Free Hospital, where the average daily admission of new surgical cases is between twenty and thirty, I have not treated more than one case a year

The description of the class of patients in whom this disease usually presents itself is given by Dr. Mackenzie in terms which, whilst they bear evidence to the closeness of the clinical observation from which he wrote, are of very great value to my argument, as being the testimony of one who had no theory to support He writes,—"The subjects of scrofulous corneitis are in general from eight to eighteen years of age, and in the female the complaint frequently appears in connexion with amenorrhea In the female as well as the male, the skin of those affected with corneitis is peculiarly coarse and flabbly, with the sebaceous

follicles of the face much developed, and I have in many (p 231) instances observed it coincident with a peculiar hoarseness of voice Other scrofulous symptoms are generally present, especially swollen lymphatic glands under the jaw, and nodes on the tibia" Having made so accurate a generalisation of its diathetic concomitants, Dr Mackenzie has evidently approached very closely to the discovery of the real nature of this peculiar form of ophthalmia, and one cannot but feel surprised that he should have missed its explanation Although I will not make so sweeping an assertion as that interstitial keratitis never occurs excepting in the subjects of inherited taint, yet I cannot conceal from myself, and have no wish to do so from my reader, that such is my present belief. I have proved it now in so many cases to the full satisfaction of much more able ophthalmic observers than myself, and have waited so long without either finding myself, or being shewn by others, an instance in which no grounds for such a diagnosis existed, that the attitude which my mind has involuntarily assumed is as just stated. It seems, moreover, improbable that a peculiar disease, remarkably well separated from all its congeners, both by its symptoms and its progress, should acknowledge a specific cause in nineteen instances, and in the twentieth present precisely the same phenomena in total independence of such origin. It is only fair in passing to ask of those who are inclined to test the accuracy of this opinion that care be taken in the diagnosis. Only typical cases of chronic diffuse keratitis must be chosen, for although the affection is unmistakeable to the practised observer in a great majority of instances, yet it has like all other diseases a border ground on which mistakes may easily be committed In certain cases of diffuse corneal inflammation occurring as a sequel to smallpox or some other of the exanthems, I have observed a combination of symptoms more or less closely simulating that presented by some of the less characteristic examples of the disease in question I have not, however, in any such instance, witnessed a simulation of its typical and more common form

As has been already done in the case of Infantile Iritis, (p 232) there will be appended to the series of cases which is to follow a

statement of the numerical frequency with which the different phenomena of this disease were actually present. I shall also attempt to elucidate in the same manner several other facts respecting its progress and events. It will be convenient, however, here to introduce a brief enumeration of its symptoms, etc.

Chronic Interstitial Keratitis usually commences as a diffuse haziness in the centre of the cornea of one eye There is at this stage no ulceration and exceedingly slight evidence of the congestion of any tunic The patient, however, almost always complains of some irritability of the eye, as well as of dim sight If looked at carefully, the dots of haze are seen to be in the structure of the cornea itself, and not on either surface, they are also separate from each other like so many microscopic masses of fog. In the course of a few weeks, or it may be more rapidly, the whole cornea, excepting a band near its margin, has become densely opaque by the spreading and confluence of these interstitial opacities. Still, however, the greater density of certain parts,—centres, as it were, of the disease,—is clearly perceptible At this stage, the comparison to ground glass is very appropriate, and there is almost always a zone of sclerotic congestion, and more or less intolerance of light and pain around the orbit from one to two months, the other cornea is attacked and goes through the same stages, but rather faster than the first. A period in which the patient is so far blind that there is but bare perception of light now often follows, after which the eye first affected begins to clear. In the course of a year or eighteen months a very surprising degree of improvement has probably taken place In milder cases, or under suitable treatment, the duration may be much less than this and the restoration to transparency complete, but in many instances patches of haze remain for years, if not for life In the worst stage, the corneal surface looks slightly granular and has lost its polish In certain cases after the ground-glass stage is passed, a yet more severe one ensues, (p. 233) in which the whole structure of the cornea becomes pink or salmon-coloured from vascularity, and in these, crescentic fringes of vessels are often noticed at its circumference In the best recoveries the eye usually remains somewhat damaged

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as to vision, and often a degree of morbid expansion of the cornea is apparent. Only in one or two cases have I ever observed ulcers of distinguishable size on the surface of the cornea, and I have never seen pustules on any part of it

My reasons for believing that this disease is dependent upon an inherited syphilitic taint are the following:—

- 1. That in certain instances patients whom I knew beforehand to be the subjects of inherited disease have, whilst under my observation, been attacked by it
- 2 That in a large number of other cases I obtained from the parents of the patient a free confession as regards themselves and a distinct history of specific symptoms in the child during infancy.
- 3. That in almost all cases the subjects of it present a very peculiar physiognomy, of which a coarse flabby skin, pits and scars on the face and forehead, cicatrices of old fissures at the angles of the mouth, a sunken bridge to the nose, and a set of permanent teeth peculiar for their smallness, bad colour, and vertically notched edges, are the most striking.
- 4. That in many cases one or more of the following suspicious forms of disease have either been coincident with it, or have occurred previously, ulcerative lupus, nodes on the bones, psoriasis on the face, otorrhoea, chronic enlargement and subsequent atrophy of the tonsils, ulcers in the throat, a thickened condition of the parts under the tongue, and chronic engorgements of the lymphatic glands ⁷
- 5. That the effect of specific treatment in mitigating the severity of these inflammations, and in shortening their (p 234) duration, is often very marked, whilst mere tonic and dietetic plans are of no avail.
 - 6. That it is often either accompanied or preceded by iritis 8

'For a more full account of the symptoms upon which, in the child or young adult, a diagnosis of hereditary syphilis may be based, the reader is referred to a paper by the writer in the "Medical Times and Gazette" for September of the current year. A yet more detailed description of the condition of the teeth in these patients is given in the last volume of the "Transactions of the Pathological Society"

⁸ Cases in which initis formed the principal symptom, and in which the cornea never became so opaque as to prevent examination of the inflamed iris will be reserved for a subsequent group. There are examples of what is described in books under the names of aquo-capsulitis, corneo-initis, etc.

Case I—Double keratitis of a month's duration—Inconclusive but very suspicious history—Suspicious physiognomy—Good result from specific treatment

William Lewis F, aged 4, brought from a village in Essex to the Ophthalmic Hospital, on account of double keratitis. Both corneae diffusely hazy, and of white ground-glass appearance The disease commenced about six weeks age, and he is now so nearly blind as to be obliged to feel his way about the room. The intolerance of light is great, and there is considerable sclerotic congestion. He is a stout boy, well grown for his age, but of decidedly "strumous" aspect. Lips thick, bridge of nose flat, teeth (first set) small, very much decayed and broken, and very irregularly placed. There are deep scars at the angles of the mouth, the result of ulcerations, which his mother states he had when an infant

His mother says that out of eleven births she has seven living children. Her first five all lived, the next four all died, the tenth is the patient, and the eleventh is alive and reported healthy. The patient was quite healthy until six weeks old, when he was vaccinated. The vaccination did not take, but subsequently a rash came out on the face, about the mouth, and on the buttocks. The skin peeled off, and there were small sores. This rash lasted more than a month, and the medical man who attended ordered "grey powders," of which upwards of thirty were given. When nine months old, a large abscess formed in the back and broke, and about this time many small ulcers appeared on his scrotum and thighs. On the question being put, his (p. 235) mother positively denies having ever had any venereal disease, but she admits that the medical man who prescribed for the boy in infancy asked the same question, and insisted that such must have been the case.

I prescribed inunction with the mild mercurial ointment The first attendance was on June 4th. On June 18th the state of the eyes was but little improved, and I thought that too little of the ointment had been used. Ordered to rub in more freely, and take three times a day two grains of iodide of potassium. On July 2nd, the note states, "The intolerance of light has

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almost disappeared. He can see fairly, and the corneae are rapidly clearing."

Case II—Remains of double keratitis of very long standing— Diathesis and physiognomy well marked—No history of infantile symptoms—Parents known to have had syphilis.

Emma Jane R, aged 14, admitted on account of slight general haziness of both corneae, the result of inflammation, which, from her mother's account, began at the age of two years, and has continued, with intervals of improvement and relapse, ever since Irides, as far as can be ascertained, not affected Complexion bad, nose sunken, scars at angles of mouth, teeth dwarfed, discoloured, and much notched Her mother acknowledges to have contracted sores from her husband, soon after marriage, for which she was for a considerable time under medical care. She denies, however, that the child had any suspicious symptoms in infancy She has borne ten children, six of whom are living, the patient being the eldest

On an old hospital letter, which this patient brought with her, the diagnosis of "strumous corneitis" had been written by the surgeon who then attended her The subject of the next case was her sister.

Case III—Remains of double chronic keratitis of a year's (p 236) duration—Diathesis imperfectly marked—No history of infantile symptoms—Parents known to have had syphilis.

Alice R., aged 12, sister of Emma Jane R, whose case is above Haziness of both corneae. diffused and exactly resembling that left by chronic keratitis. It began a year ago. There is psoriasis in the face, slight scars at the angles of mouth, and the bridge of the nose is much sunken. Teeth good, but peculiarly squared at the tops by wearing down. No symptoms in infancy recollected. Her mother had syphilis soon after marriage. It is interesting to observe that the diathesis is less marked in the younger child than in her sister.

History of syphilitic symptoms in infancy—Mother the subject of suspicious symptoms.

Sarah Lucy C, aged 12, admitted in November, 1856. Both eyes presented a leaden haziness of the corneae and vision was very imperfect. Her physiognomy was markedly that of hereditary syphilis, and there were scars of former eruptions. The irides were not easily seen, but appeared thin and discoloured. The lids were all of them affected by severe chronic tinea tarsi, and their lashes destroyed.

History—She is the second of six children Healthy up to the age of four months, when she had what her mother believes was scarlatina, on which followed severe snuffles, an eruption over the face, head, nates, and feet, and inflammation of the eyes. The eruption lasted some months, and neither the snuffles nor the inflammation of the eyes have ever since been absent. Subsequent to this and frequently since she has had troublesome sores at the corners of the lips and in the mouth. She has also had sore throat, and for long has been very deaf. Never had periosteal pains During sleep she has for a long time made a disagreeable noise in breathing. Her eldest brother died of scarlatina, aged four, (p. 237) and three sisters are living and are said to be healthy. Her father is reported to be a healthy man. Her mother is aged forty, and has now an eruption of suspicious appearance about the forehead and face, which has produced numerous small scars. There is a scar on the scalp, as if from an ulcerated node, and a second large one on the left temple, produced, she says, by the applications of caustics to "destroy a tumour" four years ago. This tumour had formed during pregnancy, and had been painful at night The scar has remained quite sound. She is liable to sore throats in winter, and suffers from very profuse leucorrhoea. Her health, on the whole, has not been so good since, as it was before, marriage, but she is not markedly cachectic. (No direct questions were asked in this case)

Case V.—Chronic syphilitic inflammation of the eyes, commencing at the age of six weeks—Syphilitic tinea tarsi—Characteristic physiognomy—Imperfect history.

William E, aged 14, the second child of a farm labourer in Cambridgeshire, (admitted in November, 1856). He is a fairly grown boy, but ill proportioned and of misshapen head. His face presents the peculiar appearance described above as characteristic of hereditary syphilis, the bridge of his nose being low, expanded, and turned on one side, on one cheek is a patch of psoriasis, and the integument generally is dry-looking, puckered, and marked in lines about the mouth and nostrils, and with small pits of some former eruption near the ears. His hair is thin and dry, and his physiognomy is further rendered peculiar by the frown acquired by having long suffered from intolerance of light

Condition of the eyes -He can only just see with sufficient distinctness to distinguish persons, and this is with the right alone, the left being capable only of perceiving light of both are tumid and corrugated, all the lashes in (p. 238) both lower lids being wanting, and those of the upper ones broken and irregular, and turned in upon the globe The cornea of the left eye is so opaque that the pupil cannot be well seen. It has lost its prominence, and is flattened, the opacity appearing to involve its whole thickness, and to be connected with a mass of coloured lymph in the lower part of the anterior chamber. The iris, where seen, appears to be thin, and of a dull slate colour The pupil does not perceptibly dilate with atropine, and it is doubtful, indeed, whether one exist or not. The sclerotic is discoloured by long congestion, and the conjunctiva is somewhat thickened by the rubbing of the inverted upper lid The cornea of the right eye is hazy in all parts, but most so in its lower half. The iris, as seen through this hazy medium, is a dull slate gray, and looks as if thinned The pupil dilates fairly under atropine, and if any adhesions exist they are very minute of the anterior chamber appears increased by pushing back of the iris The sclerotic is discoloured Both eyes are intolerant of light, and run with tears when exposed to a strong one Critchett removed the cilia of both upper lids by dissecting out their roots, and during the ten days afterwards that the boy remained under observation, the irritation of the eyes much subsided in consequence

History—Both parents are said to be ailing, his father often suffering from "rheumatism" He has four sisters, one of whom has weak eyes. He was himself a puny child, and did not run alone till five years old When aged six weeks his eyes began to inflame, in consequence, as was believed, of having caught cold, and from that time to the present he has never been able to see well. He describes attacks during which there has been much pain and intolerance of light. Three months ago he had sore throat, but there has never been any ulceration of the pharynx or palate (No opportunity occurred for asking direct questions of his parents)

Case VI—Acute and very severe double keratitis—Probable (p 239) recovery of one eye under mercurial treatment—Characteristic physiognomy and teeth—History inconclusive

Mary Ann W, aged 18, a well grown girl, who had enjoyed sufficiently good health to be out at service until her eyes inflamed. When admitted, the keratitis had existed only a month, but was very severe. Dr. Bader diagnosed the disease as syphilitic, and prescribed the bichloride of mercury, in doses of one-fifteenth of a grain, three times daily. This was on June 12th, and on August 23rd, when I saw her, great improvement had, I was informed, taken place. The right cornea was much the more opaque, and behind it were what appeared to be large masses of organised lymph, by which the iris was wholly concealed. Vision was quite lost in this eye. In the left there was diffused haziness of the corneal structure, but the iris was healthy, and there was no lymph in the anterior chamber. The stage of vascular congestion had pretty much passed off in both, and in the left the sight was already much improving

The girl's physiognomy and teeth were characteristic I had a portrait taken, showing the latter, as they were quite typical. Her mother denied any history of syphilis, but she had borne ten children, of whom eight had died in early infancy

Case VII —Double keratitis with large lacrymal abscess—Teeth and physiognomy characteristic—History suspicious but inconclusive

Mary Ann D, aged II, admitted with double keratitis in an early stage, and with abscess in the left lacrymal sac. In the posterior layer of each cornea were numerous minute punctate deposits of lymph, very closely resembling those so frequently seen in cases of syphilitic iritis in adults. There was slight swelling of both knee joints. The abscess in the sac was laid open, and mercurial treatment prescribed

She was a poor miserable-looking child, of bad pale (p 240) complexion. There were scars at the angles of the mouth, the bridge of the nose was sunken, and the teeth were most characteristically dwarfed and notched. Her mother stated that when an infant she was puny and excessively restless, and that she had "snuffles" and "thrush," both badly. She was for a long time under medical care, but did not, as far as I could make out, ever take mercury. Subsequently, she had discharge from both ears, which left deafness. Two months ago she was under Mr. Lawrence, in St. Bartholomew's, for pains in the bones and failure of sight. She was liable to severe headaches, and occasionally to epileptiform attacks.

No direct questions were asked of her mother. The patient was her second child, and she had borne four, of whom the first and fourth had been stillborn. A very singular circumstance had occurred in this child's dentition. Her mother stated that the first set of teeth had all fallen out by the time she was three years old, and that for three years subsequently she was wholly toothless.

Cases VIII. and IX—Two sisters presenting the syphilitic physiognomy and teeth—History of bygone keratitis in both.

Elizabeth D, aged 16, the elder of two sisters attending the Ophthalmic Hospital on account of imperfect sight after a long attack of inflammation. Her physiognomy was most marked, and her teeth exceedingly well characterized. The lower teeth were narrow and peggy, the upper ones narrow and deeply notched. She came complaining of short and weak sight, and stated that it had resulted from a long attack of inflammation of the eyes, which she had suffered some years before I could not obtain any positive evidence as to this ophthalmia, but her

account of it corresponded exactly with that of an attack of double keratitis. Both corneae had, however, cleared, but they retained a certain peculiar appearance of thinning which confirmed my opinion

(p 241) In Sarah Jane D, the younger sister (aged 5), both physiognomy and teeth were marked, though not nearly so characteristically as in the elder sister. Her left cornea was hazy, and was stated to have been inflamed, on and off, for two years back. I could not see their mother, or obtain any history further than that three had died out of a family of seven

Case X—Double keratitis—Partial recovery under tonic treatment—Relapse—Physiognomy and teeth characteristic—History inconclusive.

John S, aged II His mother has had eleven children born alive, of whom but three are living He is the eldest of those alive His father has lost an eye from inflammation His parents live in the country, and cannot be seen.

His complexion and teeth are most marked There are numerous scars about the face, and fissures at the angles of the mouth The teeth are peggy, not very small, but notched On the front of the left tibia is a large diffuse osseous node, in which he has had much pain. The tonsils are atrophied

He was admitted first in November, 1857, and was treated by steel, blisters, etc., up to February 18th. Both eyes were then affected, but the left was the worse, and he was quite blind of it for a time. He recovered and ceased to attend. Both eyes are now (August, 1858) relapsed, and show a diffuse, ground-glass condition, no patches are present. He is stated to have "always been a delicate, ailing lad, and his next brother is so likewise"

The above notes were taken at his admission on the second occasion, August, 1858

In reply to a letter of inquiry, his mother informed me—"when a baby, he had a slight sore bottom and mouth, which did not interfere with his health. His eyes were perfectly strong and bright until within a few days of his being brought to the hos-

pital." He had never taken mercury as far as could be ascertained

(p 242) Case XI—Double keratitis—Physiognomy not characteristic—Dwarfed lower jaw and syphilitic teeth—History of syphilis in the father before marriage

George P, aged 18, was brought up from the country by his father on Feb 2nd, 1858 Both corneae showed the initial stage of keratitis being dotted with white specks of interstitial opacity ("ground-glass-condition") The inflammation affected as yet only the central portions There was not the slightest vascularity of the sclerotis or conjunctivae, and very little intolerance of light or lacrymation He was a pale complexioned lad, but well grown and intelligent. The syphilitic physiognomy was not at all marked, the chief peculiarity in his face being constituted by an exceedingly small and under-hung lower jaw. (See portrait, in Hospital Museum, No X) His pale and delicate aspect, however, contrasted most markedly with that of his father, who was a florid, robust-looking man father told me that he had married at the age of 18, and that a year before this he had contracted syphilis, on account of the secondary symptoms of which his medical attendant had delayed his marriage six months after it had been arranged for Since his marriage he had enjoyed excellent health, and his wife had not suffered in any way The offspring of the marriage were—Ist, a daughter, living and healthy, 2nd, the patient, 3rd, a girl living, and subject to enlarged glands, of the 4th, 5th, 6th, and 7th, two were still born, and two died in infancy. besides these several miscarriages had occurred

This lad had two teeth when born which fell out before he was three months old. He was an eight months' infant, and was exceedingly delicate up to the age of seven years. He had a bad sore on one thumb (syph onychia) in childhood, which was very troublesome for a long time. For two or three years his parents "had no hope of rearing him". The right eye inflamed first about ten months ago, and more subsequently the left

(p 243) The treatment prescribed consisted of the inunction

of the mild mercurial ointment and the internal administration of iodide of potassium. These measures were steadily pursued, and on July 9th, the note states, "In the right eye the opacity is decidedly less, and he can see much better. The larger portion of the cornea in each eye is beautifully clear."

Case XII.—Double and severe keratitis—Great benefit from mercurials four years after the commencement of the disease—Typical physiognomy and teeth—Conclusive history

Emily K, aged 16, admitted with the results of double keratitis, which had existed for four years past. Her aspect was, perhaps, the most marked that I have ever seen. The bridge of the nose was flattened, there were large scars at the angles of the mouth, the skin was stretched-looking, and thin, and the complexion was pale and earthy. (See portrait, in Hospital Museum, No XI.) The teeth were small and notched Both corneae were very opaque, the deposits being dense and large. There was much irritability and some intolerance, with a sclerotic zone. It appeared that she had good eyes until the age of eleven. The left eye inflamed first, and at one time she had been all but blind.

Whilst we were examining the case, her mother spontaneously stated to Mr. Bowman and myself that she considered it her duty to acquaint us that her husband had given her the veneral disease whilst she was pregnant with the patient, and that both herself and infant had suffered severely from it. The girl had always been ailing, and she had attributed her ill health to the cause mentioned

Mr Bowman admitted the girl as an in-patient (as she came from the country), and kindly transferred her to my care. I prescribed the iodides of potassium and iron, with inunction of the mild mercurial ointment. The latter she used rather too freely, and with the result of inducing at (p. 244) the end of a fortnight a slight ptyalism. The rapidity with which the corneae cleared whilst the gums were sore was surprising, shealso gained flesh and a certain degree of colour. After leaving the Hospital she attended regularly for some months. When I

last saw her, about six months after admission, the corneae were still hazy, but she was able to read small print, and to thread her needle

Case XIII—Double keratitis, with adhesions of iris—History of syphilis in infancy—Syphilitic physiognomy

Emma C, aged 6, a puny child, in whom the physiognomy of hereditary syphilis was moderately well marked. Her mother had borne six children, of whom but two were living, and there was the history that both the latter had in infancy suffered severely from sore mouth, snuffles, and eruption of the face and buttocks. The patient was very ill during the whole period of infancy. The first inflammation of the eyes was at the age of one year. Both corneae were extensively nebulous from the effects of long standing keratitis. The pupils were both of them irregular and partially occluded. She could just see to get about. Under treatment by iodides she improved greatly, and in two months was able to see large print. The eyes were, however, permanently much damaged.

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In accordance with my original plan, I now proceed with the citation of cases bearing upon the clinical history of Interstitial Keratitis, which part of my subject is concluded in the present paper. For the deductions therefrom I may refer the reader to page 93 et seq. Should he find the cases tediously lengthy, I must plead that they are the stones out of which the edifice is to be built, and that unless care be devoted to their preparation in the first instance, it will be useless to expend it on the subsequent elaborations

Case XIV—Hereditary syphilis with clear history—vention of keratitis after having been under treatment for other symptoms—Acute inflammation—Recovery under mercury and iodides

Richard D, aged 16, first became my patient (at the Metropolitan Free Hospital) on March 12th, 1856, his complaint was a chronic abscess over the lower part of one arm He was small in stature, of syphilitic physiognomy, but tolerably florid. In addition to the abscess in the arm, he had enlarged glands in the There were pitted scars about the angles of his mouth and puckered depressions in the dorsum of his tongue He told me that his mother suffered much from "rheumatics in the head," but on my subsequently seeing her, I found that she had nodes on the ulna, humerus and the frontal bone, and was the subject of tertiary syphilis in an aggravated form She told me that, during her pregnancy with the subject of the case she had had a severe (p 55) leucorrheal discharge, and had lost her hair, and that immediately after her confinement a very bad eruption broke out attended by ulcerated sore throat She had never since been well, and had been treated by many medical men for various affections which all had assured her were of venereal origin Whilst an infant the boy himself had severe and protracted "snuffles," also ulcers in the mouth and at its angles, eruption on the buttocks, and sores at the anus He had ever since been very ailing, and had had abscesses about the left elbow which had left it stiff I treated him with iodides, and the ulcer on the arm soon healed, he improved very much in general health, and shortly afterwards was apprenticed to a plumber

Here then we have a case in which beforehand not a shadow of doubt exists as to the patient being the subject of inherited syphilis

On September 16th, of the same year, Richard D applied to be readmitted on account of an attack of inflammation in the right eye which he attributed to his having worked all day over a hot brazier. He had taken, with some irregularity, an iodide mixture almost ever since his first attendance, but had now left it off for several weeks. His right eye showed commencing keratitis in an acute stage. The sclerotic was much congested, but chiefly in the outer side, and there was a well marked zone. The cornea was granular, but chiefly in its posterior layers. The iris was muddy, but not tumid, nor did it show any effused nodules of lymph. Some intolerance of light and some circumorbital pain existed, but neither of them were severe. The inflammation had existed for a fortnight. The dose of iodide was increased

in the former draught, and on the 22nd the condition of the eye was rather better I then ordered the iodide in eight grain doses From September 22nd he did not attend again till October 16th, and then came, begging that I would again order him his former medicine, as he feared he had quite lost his eye. The whole of the cornea was now densely opaque and vascular, so that no part of the (p 56) iris could be seen There was great intolerance of light and lacrymation, and the sclerotic was much congested I found that he had been attending at his master's wish at an ophthalmic hospital The letter which he brought me showed that "strumous corneitis" had been the diagnosis of the surgeon whom he had there seen, and that tonics, cod-liver oil, and counter-irritants had been employed I at once changed this plan, and reverted to the iodide draught (grs viij), under which, at first, improvement had very satisfactorily set in tensity of the inflammation was, however, so great that the cornea was already bulging at its outer part, and I entertained great fear for the eye On the 24th, however, great improvement had taken place, and I could just distinguish the iris at the upper and inner part The left eye had been very irritable and somewhat congested, but the opacity of the cornea in it never advanced far

On November 4th the note states that he could see to read with the left and that the right was still improving. The dose of the iodide was now increased to ten grains, and inunction of the mild mercurial ointment was also commenced

On December 6th the note is, "Considerable but by no means rapid improvement. The left eye is now nearly well. With the right he can see the light, but the cornea is still quite opaque. It looks bulged and too prominent. Its discoloration is peculiar, not merely a ground-glass opaqueness, but of a bluish grey colour (leaden) with in some parts a purple tint. There is a well-marked sclerotic zone." The iodide, in reduced doses, was continued as well as the inunction

On February 6th he could see to count fingers, and in the course of six months further the cornea had cleared sufficiently to allow him to read At present (two years after the attack)

there is still a white opacity in the outer part of the cornea, but its centre is quite clear and the sight very fair

This case is of importance only because the diagnosis (p 57) is beyond cavil, but on account of its exhibiting in a strong light the uselessness of the remedies for struma and the efficiency of those for syphilis

Case XV — Double keratitis—Healthy physiognomy, but characteristic teeth—History of syphilis in the mother

James D, aged 8, well grown, stout, and moderately florid,

applied at the hospital on January 3rd, 1859 The physiognomy of hereditary syphilis was not at all characterized His nose was small, and the face, where not florid, presented a peculiar faded vellow tinge which I have often before noticed under similar circumstances, but there was certainly nothing which would have excited attention He was, however, the subject of double interstitial keratitis On looking at his teeth, all doubt as to the real nature of the case was dispelled The lower incisors, just cut, were large, but presented singularly irregular edges, being thin and unequally serrate The upper incisors were all deeply His mother told me that she had borne two children since his birth, and that both had been very delicate and had died under two years The patient was her only living child, and during infancy he had been very ailing indeed. On the question being asked, she at once acknowledged that she had had the venereal disease It was contracted, she said, from her first husband, who gave her it soon after marriage, and himself died within six months During her years of widowhood she was an in-patient at the London Hospital for ulcers about the knees which were considered to be syphilitic At length, believing herself cured, she married again, her second husband, whom she believed to be quite healthy, being the father of her children

With regard to the keratitis in this case I have only to remark, that it was well characterized and of moderate severity. It had existed six weeks when I first prescribed for him, and was advancing. There was some sclerotic congestion and slight intolerance of light.

(p 58) The case is of much interest on account of the absence of the syphilitic physiognomy and the presence of the dental peculiarities showing the especial value of the latter as aids in diagnosis. No doubt the boy's healthy aspect was due to his having had a healthy father

Case XVI—Interstitial keratitis in its initial stage—Notched incisors and other suspicious symptoms—Imperfect history

Eliza P, aged 18, admitted January 13th, 1859 She was a moderately florid girl, but her face was so much pitted with small-pox as to prevent any other peculiarities of physiognomy from being noticeable The keratitis was only just commencing She had enjoyed, she said, excellent sight until three weeks ago when the left eye began to inflame In the centre of the left was now a patch of diffused dimness of most characteristic appearance ("ground glass") The sclerotic was slightly congested, and there was some intolerance of light The other eye was "a little weak," but presented no traces of inflammation The bridge of her nose was wide and rather sunken The left upper incisor had a broad central notch, and the other teeth were of suspicious form The lower incisors presented an ill-marked horizontal notch

As to family history the girl stated that she was the third of seven who were living

Her eldest brother (now aged 22) had, when about ten years old, suffered from bad eyes for a long time, but had now quite recovered. She believed he had been quite blind for some months

In this case I could not see either parent, as they lived in the country. As the facts are rather scanty, I may state, that Mr Streatfeild, who kindly transferred the patient to my charge, had made the diagnosis as to hereditary syphilis before doing so Mr Hulke and Dr Bader, both saw the girl and fully agreed in the opinion that her (p 59) aspect, state of teeth, and keratitis taken together warranted the belief that she was the subject of inherited taint.

Case XVII — Suspicious physiognomy and characteristic teeth—Remains of interstitial keratitis in both eyes.

Henry C, aged 14, admitted on account of the remains of chronic keratitis in both eyes. All congestion had long since disappeared and only dim white interstitial clouds of opacity remained. The bridge of his nose was broad and rather flat, teeth most characteristic, being notched and tuberculated. There were wide spaces between the incisors, and all the four canines showed a central tubercle. He stated that he was the third of four living children. A sister had suffered from "bad eyes". His mother was dead and I had no opportunity for obtaining an account of his infancy.

Case XVIII—Double keratitis—Suspicious physiognomy and characteristic teeth—History of symptoms in infancy and of syphilis in her father.

Caroline E, aged 20, the eldest of several children She was a pale cachectic girl, but her physiognomy was nowise characteristic. Her upper incisors were deeply notched and of unmistakable contour. Both eyes were affected with chronic keratitis which was, however, most severe in the left. Her mother told us that as an infant she had been puny and ailing, and could not walk until more than two years old. She then had snuffles very badly, and for a long time, and she still has nasal obstruction. She was much under medical treatment in childhood. Her mother confessed that she was aware that her husband was suffering from the venereal disease soon after their marriage, but denied that he had ever communicated it to herself

Case XIX—Opacities in each cornia—Clear history of (p. 60) inherited syphilis—Peculiar forms of caries in the upper (deciduous) teeth

Caroline P, aged 6, in both corneae were opacities, the result of bygone disease, but they were more superficial than those usually seen after specific keratitis. All the incisors of her upper set (milk teeth) were decayed, the laterals had fallen, the centrals were affected with black caries, and the canines were

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reduced by wearing away of their outer layers to the peculiar condition of central tusks which I have elsewhere fully described Her lower teeth were of white colour, and all of them perfect Her mother stated, that soon after marriage (ten years ago) she had contracted syphilis from her husband. Her first three infants all died within a few months of birth. The patient was her fourth, and was born healthy, but from the age of six weeks to that of a year she suffered severely from rash on the buttocks and body, sores at the anus, and snuffles. The eyes first inflamed when she was a year old

Case XX—Double keratitis—Recovery under specific treatment—Very suspicious family history—Black caries of deciduous teeth in two sisters

Emma J, aged nearly 4, when two years old, both corneae were attacked by interstitial inflammation, from which some opacity still remains For a time she was nearly blind the last six months she has been taking the bichloride of mercury, under Dr Bader's prescription, with great benefit both to her general health and to her eyes Her aspect is most marked, nose sunken and broad, angles of mouth puckered by old fissures. Her mother gave me the following history of her family The first two died within a few weeks of birth The third is living, but suffered when an infant from bad snuffles, and now shows fissures at the angles of the mouth and black caries of her upper teeth (deciduous). The fourth is the patient, who also suffered from snuffles and (p 61) had double purulent ophthalmia in infancy The fifth is a baby now two years old, large and well grown, but whose upper incisors are already affected with black caries No direct questions were asked

Case XXI—Commencing keratitis—Marked physiognomy— Loss of upper teeth, with exfoliation of bone—Nodes on tibiae— Glandular abscesses—History of syphilis in father

Charles G, aged 14, a most marked physiognomy, sunken nose, fissures at angles of mouth and pits in the cheeks, large scars of ulcerated glands in the neck. The anterior part of the

alveolus of the upper jaw has been exfoliated, and the gum is still much swollen. All the upper incisors are wanting. The lower incisors are deeply serrate, and in the side of one of the upper canines, close to the gum, is a remarkable tubercle. Both his tibiae are bent forwards, enlarged, and of uneven surface, he has had much pain in them. His mother states that she knows that her husband had "the disease" before marriage, but denies that he ever gave it to her. She looks fairly healthy, but says that since marriage she has never been so well as before

Charles G is her first child. In infancy he had very bad snuffles, a rash on the body, and sores at the anus which lasted a long time. "He took a great many powders." The second child suffered also from rash and snuffles, and was for a long time very delicate. The third and fourth are living, and are said to have never shown any suspicious symptoms. The fifth died soon after birth, and the sixth died of "water on the brain," at the age of three years

Charles G is himself fairly grown. The abscesses in the neck first showed themselves when he was three years old, and at the same time the eyes were affected. For a fortnight past the left cornea has been inflamed, and it now presents a characteristic condition of "interstitial keratitis," the deposit being chiefly in its upper third

The above are the notes taken of a case which Mr. Streatfield (p 62) kindly transferred to my charge on November 11th, 1858 About the diagnosis there could be no doubt whatever

Case XXII—Interstitial keratitis in its early stage—Characteristic physiognomy and teeth—History of constitutional syphilis in the mother—Symptoms of syphilis present in infancy

Sarah Ann H, aged 8, physiognomy characteristic, features contracted and drawn, skin pale, harsh and dry, fissures at angles of mouth and pits in other parts of face. Neither incisors nor canine teeth in the upper jaw. Her mother states that she did not cut them until about a year old, and that within six months they had become black and rotten. From two years old to the present time she has been without them. The permanent teeth

are just showing The lower incisors (permanent) are very small and peggy, with conical growths on their surfaces. Since the age of one month, she has always had "a bad cold in the head," which is aggravated by the slightest cause. In infancy she "snuffled very bad indeed" She also had what her mother considered "thrush," and for a long time her anus was very sore Her mother is not aware that she ever took mercury, indeed she was never under such medical treatment She is deaf, and has for a long time suffered from otorrhoea For some time past she has complained of dimness of sight, and that the eyes "watered very bad" The corneitis is in its initial stage and began about a week ago In the centre of the right cornea is a patch of white deposit which gradually edges off, and which when carefully looked at is seen to be interstitial No congestion of the sclerotic, and no haziness of other parts of the cornea or swelling of the Some intolerance of light, and lacrymation

Her mother, although of fairly healthy aspect, tells me that she has never been really well since her marriage. She is not aware that she ever had primary symptoms, but once suffered from a severely ulcerated throat which the medical (p 63) man who attended her said was venereal She has been pregnant only three times, and all her children are living The patient is the eldest The two others are healthy, but both have squints which in the youngest is referred to "an attack of inflammation of the brain" The youngest lad had sores at the anus and a discharge from the ears

On examining the mother's throat there were seen the cicatrices of an extensive ulceration The left side of the velum had been partially destroyed and the uvula was tied up to it by adhesions

Case XXIII—Double keratitis—Characteristic physiognomy and teeth—History not obtained

Emma W, aged 19, but looking like a woman of 30, was admitted under Mr Critchett's care with keratitis of both eyes The disease had begun in the right eye a month age and had attacked the left three weeks later The right cornea was dim in its whole extent, and its surface wanting in polish, there was a

fringe of vessels passing into its surface from above and a smaller one from below. In the left the affection was less advanced, but the same fringes existed in a less degree

The patient was married, and was suckling an infant ten months old. The outbreak of the disease had probably been induced by the debility caused by lactation. She was extremely cachectic and pale whilst both her complexion and teeth were most characteristic of the heredito-syphilitic diathesis. She had never had inflamed eyes before. Mr Critchett was good enough to transfer her to my charge. I ordered that the infant should be weaned and ventured to prescribe iodides and mercurials.

Case XXIV.—Remains of chronic keratitis—Deafness—Attack of iritis—Physiognomy and teeth suspicious—History of syphilis in infancy

John B, aged 21; his aspect was such that I suspected hereditary syphilis the moment I saw him, more than this (p. 64) cannot be said, neither his teeth nor any single feature were so positively marked as to make the diagnosis conclusive The corneae were both of them thinned and prominent, as if they had formerly been inflamed, and in the left was still a slight haze. His mother told me that his father and uncle were surgeons, and that they both considered that the lad's ailments were due to "the disease" contracted in infancy A rather roundabout story was, however, told as to the mode of its acquisition. It was stated that he had been put to the breast of one of his aunts at the time she was suffering from a specific eruption, and that he afterwards had a breaking out of sores on the body which lasted a long time He had also bad snuffles and sores at the anus After that, he was very ailing until aged 8, when an inflammation of the eyes occurred, for which he was for a long time under Mr. Dalrymple's care, and which made him for a time quite blind (Qy chronic About the same age he had double otorrhoea, which left him quite deaf, as he still is

This young man was admitted not on account of the keratitis, which had indeed long passed away, but for a sub-acute iritic

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attack in the left eye Under mercurial and iodide treatment this soon passed off and the other eye did not suffer.

Case XXV—Chronic keratitis in one eye—Suspicious physiog-nomy—History not obtained

Sophia H, aged 23, married Her only child had died in convulsions, aged three months She came on account of inflammation of the left eye of a month's duration. The disease was interstitial keratitis in a well characterised form. The bridge of her nose was broad and low, her complexion pale with many small pits. Her elder sister came with her and stated that she also had suffered from inflamed eyes. In neither of them was the physiognomy more than merely suspicious. In both the teeth were broad and large, but of bad colour and peculiarly squared at their sides. Their parents were dead and I had no opportunity for obtaining any history of their symptoms in infancy.

(p 65) Case XXVI.—Keratitis occurring in one eye long after the other had recovered—Characteristic physiognomy—History denied

Henry P, aged 12, he is the second of four. The eldest died, aged 4, of measles, the third died, aged eight months, of "very bad thrush", the fourth is living and reported to be healthy. He is stated to have been a healthy baby, but has been very delicate of late years. His eyes first began to suffer about two years ago, and he attended at the Moorfields Hospital nearly blind for some weeks. There is now a dim opacity in the right cornea from bygone inflammation. The left cornea is acutely inflamed and shows numerous reddish punctate deposits of lymph in its structure. The sclerotic of the left eye is congested and the intolerance of light is great. His father, who comes with him, is a pale cachectic man, but he denies with warmth any history of syphilis. Against his denial are the existence of large symmetrical scars at the angles of the mouth and below it almost to the chin, of a flattened bridge of the nose, of psoriasis on the face,

and of stunted and notched teeth. The boy's physiognomy is indeed most marked

Case XXVII.—Interstitial keratitis—Deafness—Characteristic physiognomy and teeth.

Walter R., aged 8, admitted in July 19th, 1858 Dr Bader then saw him and made the diagnosis of "syphilitic corneitis," and prescribed mercurials I saw him in October, and both corneae had then cleared to a great extent. The irides were leaden and lustreless. His physiognomy and teeth were both quite characteristic. He was deaf on both sides from otorrhoea some years ago. His mother denied all history of venereal disease in herself or her husband. She said that when born the child was a fine baby, but that he rapidly wasted, and was so excessively fretful that he was (p. 66) always crying when awake. He grew up a little puny child, and for years was almost constantly under medical care. He was the eldest, two younger were stated to be living and healthy

In this case, as in many of the others, the diagnosis of hereditary syphilis was not made originally by myself, a fact of considerable value as confirmatory of the correctness of the opinion

Case XXVIII.—Recent attack of keratitis in one eye—Characteristic physiognomy—History of infantile syphilis

Emma M, aged 8, the second of seven living children Her mother had lost seven in early infancy. The one still living, older than the patient, was stated to have suffered from a similar affection of the eyes from which she had been blind for several months, but had subsequently quite recovered. A third in the family is still subject to tinea tarsi. In Emma M the aspect of hereditary syphilis was well marked, there were fissures about the alae nasi and at the corners of the mouth, and also scars in the soft palate. The history given was that in infancy she had suffered from thrush and snuffles both very badly, and had also had an eruption on the body. The keratitis had commenced about a fortnight before she applied at the hospital, and as yet the left eye only was affected. In the centre of the left cornea.

was a large diffused patch resembling ground glass, but a little reddened. The intolerance of light was but slight. Quinine, blisters, etc., were prescribed and continued for about a month, but with no advantage, when treatment by the iodides was substituted.

Case XXIX—Remains of double kerato-iritis—One eye lost by iritis in infancy—Physiognomy and teeth characteristic—History of infantile symptoms—Syphilis in both parents

Amelia L G, aged 20, (portrait No 7 of the stereoscopic (p 67) series in the Museum of the Moorfields Hospital) patient, a governess, whose parents had once been in very good circumstances of life, was brought up from Liverpool to be placed under Mr Critchett's care on account of the effects of chronic kerato-ırıtıs Her aspect was most characteristic, complexion pale and earthy, lips fissured, nose broad and sunk, numerous small pits in face. The teeth were small, peg-shaped and notched, all the molars had already decayed and come out. She was stated to be liable to hoarseness, but no destruction of palate had occurred She had suffered much from pain in different bones and near the extremities of both radii were periosteal enlargements of old standing Her aunt, who came with her, stated that she had been a very delicate baby, and had then suffered from long continued snuffles, attended by a rash on the face She was the eldest living Her mother had borne eleven children, of which the first six all died very young (most of them were premature births), the seventh was the patient, the eighth was still living, but was liable to fits and suffered from weak eyes, the ninth, tenth, and eleventh, all still living, were reported to be healthy

With regard to the eyes — "There is a slight divergent squint; the right eye is lost, its cornea being thinned and bulging, and the pupil completely occluded by a white membrane which looks chalky The left pupil dilates irregularly under atropine, and the iris is thinned and much deficient in lustre Both corneae look as if they had formerly been extensively opaque, but are now nearly transparent in most parts Her right eye is said to

have been lost by inflammation in early infancy. At a subsequent period, however, (about aet. 9), she again had inflammation of the eyes, and on this occasion the left also suffered and she was blind for some weeks."

As her parents did not attend, of course, no direct questions were asked. About three weeks after her admission, however, her aunt one day told me quite spontaneously, that (p. 68) her mother thought we ought to be informed that she had suffered from "the disease" soon after her marriage, and that the child had received it from her

Case XXX—Effects of bygone keratitis (double)—Aspect of hereditary syphilis well characterized.

Thomas R, aged 22, a pale cachectic looking man in whom the aspect of hereditary syphilis was very marked. He stated that he had been very delicate in childhood. His lips were deeply fissured by former ulceration, and his teeth were small and notched. Both eyes presented the appearances of past keratitis. The anterior chambers were large, the corneae slightly dim in parts and flattened. The irides looked thin and were rather green in tint, but there were no pupillary adhesions. The eyes had first inflamed four years ago, and he had been under treatment at different institutions ever since. The affection attacked the right eye first. For four months he was so blind that he could but just see a candle. No opportunity occurred for getting any history of his symptoms in infancy.

Case XXXI—Hereditary-syphilitic diathesis and history—Acute keratitis of the left eye, cured by mercurials—Right eye subsequently attacked—Good effects of specific treatment

Eliza B, aged 8, admitted July 1857 A pale emaciated and puny child, aspect of hereditary syphilis well marked, and history of suspicious symptoms in infancy. Out of nine births her mother had but two living children, four miscarriages had occurred, and three infants had died young

The left cornea was, at the time of admission, the only one affected It had been attacked five weeks before Mercurial

inunction was resorted to, and it rapidly cleared In November, however, the right eye was attacked and suffered much more severely than the other had previously done When readmitted the right cornea was wholly opaque, and very red, the opacity in its centre was extremely dense, no glimpse of the iris could be obtained There appeared to be a mass of lymph in the anterior chamber adhering to the posterior surface of the cornea, but as to this fact, appearances might be deceptive. The sclerotic was much congested and there was moderate intolerance of light Five grains of the iodide of potassium were ordered to be taken three times a day, and the mild mercurial ointment to be rubbed in night and morning These medicines did not disagree, and within three weeks great improvement had resulted The cornea was then clear excepting at its centre, the lymph had been wholly absorbed from the anterior chamber, and she could see with the eye very fairly

My note in this case says, "at one period the state of the eye looked hopeless" The effects of specific treatment were exceedingly well marked in the case of each of the eyes. It must be borne in mind, however, that the second eye was attacked within two months of the suspension of this treatment, and that it suffered more acutely than its fellow

Case XXXII—Acute keratitis in both—Syphilitic aspect and suspicious history—Tonic treatment—Partial recovery in six months

Mary Ann B, aged II Aspect of hereditary syphilis very marked Of eight conceptions her mother had but two children now living, most of them having resulted in stillbirths. When an infant M A B had a badly ulcerated mouth and sore lips, as proof of which deep puckered cicatrices still remain. Her mother now has psoriasis of a suspicious aspect about her face

The right eye had been first attacked six months ago, and a few weeks later the disease appeared in the left also. The corneae became so opaque that she was quite blind for some weeks. I did not see her until five months after the onset, and the acute stage had then passed away. Both corneae were slowly clearing,

the right being dimly granular throughout its structure, and the left having in its centre a dense (p 70) red vascular opacity Both looked thinned and expanded She had been treated for "struma" only, having taken codliver oil and tonics My note adds, "It is probable that both corneae are permanently damaged, especially in form."

Case XXXIII—Physiognomy and history of hereditary syphilis—Keratitis in both eyes—No specific treatment—Both corneae permanently damaged

Catherine B, aged 17, physiognomy typically that of hereditary syphilis Bridge of nose fallen and very wide, bad earthy complexion, puckered fissures at the angles of the mouth; face pitted by the scars of a bygone eruption. Her mother stated that in infancy she had had snuffles very badly indeed, also sore throat, and what was considered thrush Subsequently she had discharge from both ears, which has left her partially deaf. Out of fifteen, her mother has but five living children Most of them suffered from severe snuffles in infancy

The right eye was the first to be attacked, and the left suffered very shortly afterwards. She was quite blind for three months, and was under treatment at another hospital. I did not see her until three years after the attack, and her condition was then as follows.—"Both pupils irregular, and the irides discoloured and thinned Both corneae opaque by granular white dots, and slightly expanded and misshapen Sclerotics thinned and bluish The eyes are still very irritable, and she cannot see sufficiently to distinguish the largest type"

Case XXXIV—Aspect and history of hereditary syphilis— Effects of double keratitis still remaining nearly three years after the attack

Charles D, aged 6, the third of five living children His mother had had three miscarriages, but had not lost any infants born alive He was stated to have been a puny (p 71) infant, and to have had no finger or toe nails for some months: did not walk until more than two years old Has been liable to enlarge-

ment of the glands in the neck which have been ulcerated for eight months past. Aspect of hereditary syphilis well marked

Both eyes inflamed almost coincidently nearly three years ago, and he was quite blind for several months. When I saw him for the first time two years and a-half after the acute disease, both corneae were still opaque in their centres and much expanded and misshapen. The irides were thinned and the pupils, which could not be distinctly seen, appeared to be adherent in parts. The globes were small, and had acquired a peculiar rolling motion. Tonic treatment only had been employed.

Case XXXV.—Aspect and history of hereditary syphilis— Effects of past kerato-iritis in both eyes

Mary M, aged 15, came under my care amongst the outpatients at the City Hospital for chest diseases, in October 1855 She was the eldest of thirteen children, out of whom five had died young. Three had suffered from suspicious symptoms in infancy. She was stated to have been a healthy infant when born, but at three weeks old had severe "thrush" and snuffles. The mouth became very sore, and sores also formed at the anus, which lasted nearly a year and were difficult of cure

In both eyes were the results of long past keratitis. The corneae were opaque in spots, and the irides were thinned, and discoloured; there were also some pupillary adhesions. The girl's aspect was characteristic of hereditary syphilis, but at that time I was not aware of the peculiarities of the teeth, and did not examine them. Whilst she was under treatment her mother was delivered of her fourteenth child. The infant was a fine one, but within a few weeks fell away and suffered from severe snuffles, with a characteristic copper-coloured rash. It recovered under mercurial treatment. The (p. 72) history of the family, therefore, presents us with a remarkable illustration of the long persistence of specific taint in the system of the parents, of its falling with great severity on the first born, and very unequally on subsequent ones.

Case XXXVI —Hereditary-syphilitic aspect and history—Old-

standing inflammation of both corneae, and large staphyloma of one of them

Emma M, aged 9, of most marked syphilitic aspect. Nose sunken, laryngeal breathing with aphonia, nodes in front of both tibiae, large cicatrices in the pharynx. In infancy she was reported to have suffered severely from "thrush," snuffles, inflamed eyes, etc. Her mother had been twice married. By her first husband she had born seven healthy children, but by the second, three successive still-births (at full time), and then the patient, since the latter, five others have been born, of whom four have died with suspicious symptoms in early infancy

The right eye was quite destroyed by a large staphyloma of the cornea In the left the cornea was extensively opaque and dotted with white spots of interstitial deposit. The iris, as far as could be seen, appeared thin and discoloured. The lids were affected by chronic tinea tarsi. The history given was that repeated attacks of inflammation had occurred in the eyes from infancy up to the present time.

Case XXXVII—Double kerato-iritis occurring at the age of ten—Latency of symptoms up to that age—History of syphilis in the mother

Mary O, aged 11, aspect of hereditary syphilis most marked, nose destroyed, by erosive lupus, to a level with the face, uvula and soft palate also wholly destroyed. Her mother's eldest and only living child. No suspicious symptoms appeared to have occurred in fancy, but her mother acknowledged (p. 73) that soon after marriage she had contracted "the disease" from her husband, and that it had been followed by constitutional phenomena. The child appeared to have remained well until ten years old, when the disease broke out almost simultaneously in the throat, eyes, and face

In both eyes were the evidences of a now passing attack of corneo-iritis. Both irides were discoloured and thin, and the corneae slightly opaque by spots of deposit in their structure

Case XXXVIII —History and aspect of hereditary syphilis—

Double kerato-iritis—Aphonia—Deafness and ulceration of the

palate

Elizabeth H, a patient at the City Hospital for Diseases of the Chest in 1852 The eldest of three, the others reported healthy, but liable to eruptions Father, a dissolute man, much subject to scaly eruption and sore throats Although born healthy, the child, at the age of three weeks and from that to a year, suffered from severe snuffles, she also had the "thrush" badly After that, however, until the age of five she was a stout, healthy-looking child The eyes then inflamed and soon afterwards the throat ulcerated, and subsequently she became deaf

She was a puny girl of most marked syphilitic aspect. There was active ulceration of the posterior pharynx and pillars of the fauces, whilst the uvula and large part of the soft palate had already been destroyed. She was quite deaf, and suffered also from aphonia, with laryngeal whistling during cough

Although the disease had commenced ten years ago the corneae were still so hazy that the irides could not be distinctly seen The pupils, however, appeared to be partially adherent, and the iris structure thinned and slate-coloured

The girl remained under Dr. Risdon Bennett's treatment for some months on account of her throat, and derived great benefit from mercurial fumigations and the administration of the iodides with tonics. No material change took place in the state of the eyes whilst she remained under my observation

Case XXXIX—Remains of kerato-iritis in both eyes—Aspect of hereditary syphilis—Palate and nose destroyed by ulceration

Alice S., aged 17, a girl in whom the aspect of hereditary syphilis was very marked. The soft palate was destroyed, and the bones of the nose lost by necrosis, there was psoriasis on the face and fissures at the angles of the mouth. Her mother had but four living out of ten children. The patient was the third born, but the oldest living; all the six had died in infancy. No history of infantile symptoms was given, her mother stating that all her ailments dated from the age of three years when she

had a pea put into one nostril which caused the ulceration to commence

In both eyes were the effects of a past attack of kerato-iritis. The corneae were thinned and expanded, and still slightly opaque, the irides thinned and the pupils notched. The first attack had commenced eleven years ago, and she had been under many ophthalmic surgeons. I much doubted the truthfulness of the statement that the hereditary taint had been latent until the age of three. Mr Curling, under whose care she subsequently came, in the London Hospital, effected much good by a plastic operation for the restoration of her nose

Case XL—Aspect and history of hereditary syphilis—Subacute keratitis in both eyes—Benefit from specific treatment.

Mary N, aged 9, of characteristic physiognomy, but well grown and fairly florid She was the second of six, out of whom only three were living, and several had had suspicious symptoms in infancy. She herself had when a baby inflamed eyes, (p 75) very troublesome snuffles, a sore mouth, and an ulcerating eruption on the body, which has left many scars All symptoms left her at the age of two years, and from that time till the eyes were attacked (an interval of nine years), she was quite well

The left cornea was first attacked in December 1856, and the disease soon followed in the right eye. She had much circumorbital aching. Both corneae became very opaque, pink, and misshapen. She took tonics, etc., at first, and the progress was very slow. The improvement became much more decided, though still very gradual, when iodides were ordered.

Case XLI—Both eyes permanently damaged by an attack of kerato-iritis—Hereditary-syphilitic physiognomy

Matilda S was admitted under Mr Bowman's care, both her eyes having been permanently damaged by an attack of keratoiritis which had occurred fourteen years before. Her sight was very imperfect, pupil immobile, irides thin and discoloured; corneae opaque, and extensively dotted. The globes had ac-

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quired a certain oscillatory motion⁹ generally indicative of the sight having been much interfered with from early childhood. The history given (I did not see her mother) was that, when five years old, she had caught cold in the eyes, and soon lost sight in both. She had never yet menstruated, and was very liable to sore throats. Her aspect was very markedly characteristic of hereditary syphilis; lips fissured, etc. She was quite deaf, her hair thin, patches of psoriasis on the face. In childhood she had had long-continued otorrhoea. The diagnosis of hereditary syphilis was Mr Bowman's, and I was indebted to him for having (p. 76) my attention drawn to the case. Mr. Bowman subsequently made an artificial pupil in one eye with considerable benefit. The condition of the corneae was such as to preclude a satisfactory inspection with the ophthalmoscope. Very probably there were also deep-seated changes.

Case XLII—Double kerato-iritis coincident with phagedenic destruction of the nose and soft palate.

Mary D., aged 8, Irish. Of this case I have no further notes than that the nose was destroyed, level with the face, by phagedenic ulceration, that the soft palate was also destroyed, and that further both eyes were affected by kerato-iritis in a severe form. The child came under my observation in St Bartholomew's Hospital. I considered the case one of hereditary syphilis

Case XLIII.—Kerato-iritis in the left eye—Similar attack in the right more than two years afterwards—Syphilitic physiognomy—Nodes, etc

Annie M'Q, aged 14, came under my observation when an inmate of St. Bartholomew's Hospital under the care of Mr. Wormald, by whom the syphilitic nature of her symptoms had

⁹ Does this symptom usually indicate a diseased condition of the deeper parts? It appears as if the eye were rolled about in the hope of getting the rays of light on to the tracts or points of retina yet remaining sensitive. May it not also occur where the cornea is extensively impaired in transparency, especially where the opacities are in distinct small dots?

been fully recognized. She was a puny child of most characteristic aspect. There were nodes on both tibiae, and puckered cicatrices at the angles of the mouth. She was an only child and an orphan, and no history of her infancy was obtainable. About three years ago one of the nodes in the tibia ulcerated, and a piece of bone came away. Nearly at the same time her left eye inflamed, and continued so a long time. The sight was attacked for the first time only three months ago. Much pain in the orbits had attended the attack.

At the time that I saw her, three years after the outbreak of the disease, both irides were thin and mottled in colour, the pupils were adherent and irregular, and the corneae (p 77) opaque in their deeper layers. The eyes appeared to be permanently damaged

Case XLIV.—Severe keratitis in both—History of infantile syphilis with syphilitic physiognomy

Julia H, aged 10, came under care at the Moorfields Hospital nine months after the outbreak of kerato-iritis in both eyes and in a severe form. She had been treated by tonics only, and the disease was scarcely yet on the decline. Much yellow-brown lymph had been effused into the anterior chambers, in contact with the posterior layers of the corneae. The corneae were very red, and there was considerable sclerotic congestion. At first there had been great intolerance of light, and much circumorbital pain

Great improvement rapidly ensued on the adoption of specific treatment

The evidence as to syphilis was that her aspect was very characteristic, and that she had suffered from severe snuffles and eruptions on the nates in infancy. Her mother had a suspicious eruption on the face.

Case XLV—Chronic keratitis in one eye only—Characteristic physiognomy and teeth

Eliza D, aged 14, was admitted on February 28th of the present year, in the third month of an attack of keratitis, by

which the left eye only had been affected. The opacity was considerable, but already declining. Her physiognomy was most characteristic, complexion earthy and pale. Her upper incisors were small and notched, they were also crowded and irregularly placed on account of a portion of the alveolus having exfoliated in childhood.

As to family history, I learnt only that there were five children living, of whom she was the eldest, that her father had been a very dissolute man, and that her mother was in an asylum

(p 78) Case XLVI—Double chronic keratitis—Characteristic physiognomy and teeth—Improvement when under specific treatment adopted for the first time more than two years after the outbreak.

John E K, aged 16, was admitted at the Ophthalmic Hospital on June 10th, 1858; Dr Bader at once recognized his diathesis, and prescribed the bichloride of mercury in small doses not see him until March of the following year It appeared that he was an only living child out of three His father was in the country, his mother in an asylum, so that no family history could be got. His aspect and teeth were most characteristic of hereditary syphilis He had suffered from a most severe attack of keratitis in both eyes which commenced more than three years He was admitted at this hospital originally within six weeks of the outbreak, and having attended for seven months without benefit left and placed himself under treatment elsewhere. He became so nearly blind that he was for a long time only just able to distinguish light from shadow He was in this state when admitted, and had been so for more than six months The attack had lasted two years and eight months when on June 10th, 1858, Dr. Bader ordered the bichloride in doses of the fifteenth of a grain three times a day So far as could be ascertained no specific treatment had ever before been adopted The bichloride was continued until March 7th, 1859, when he had so far improved that the opacity was limited to the centre of the cornea, and he could with the left eye see to read small pica type

Case XLVII.—Double chronic keratitis—aspect suspicious and teeth characteristic

Frances W, aged 14, the subject of chronic keratitis in both eyes of two years' duration. Her aspect was moderately well characterized, but the teeth much more positively so. She was liable to violent pains in the bones of the head, and her face showed numerous small pits left by some former eruption. I have preserved no note as to her family history. She was admitted on account of a relapse of inflammation of two months' duration. Both corneae were extremely hazy

Case XLVIII.—Acute keratitis in one eye—Suspicious physiognomy and teeth—History of syphilis in infancy.

Mary Ann L, aged 12, a pale unhealthy-looking and feeble girl, was admitted on March 7th, 1859 Her left eye had been attacked a month before by acute keratitis, and there now appeared to be a deposit of pus in the centre of the cornea between its layers. The whole surface of the cornea was of deep cherry red colour from the interlacing of minute vessels. It was quite opaque and bulged considerably. The girl's gums were sore from a rapid mercurial course which had been exhibited prior to her application at the Hospital. The other eye was not in the least affected. The history was most conclusive. Her mother stated that she had contracted the venereal disease from her husband soon after marriage, and that the patient (her first born) attended St. Bartholomew's Hospital until a year old on account of a rash about the nates, and other symptoms which were attributed to inherited taint. When about a year old she improved in health, and from that time until the present had never required treatment for any specific symptoms; of four children born subsequently, two had died in infancy.

In this case, notwithstanding the clearness of the history, the disease advanced in spite of specific treatment. The girl had been salivated before she came, and during the first ten days of her attendance as an out-patient iodide of potassium was exhibited in three grain doses three times daily but with no good effect. The inflammation was acute and disorganization of the

cornea was threatened Believing that the intractibility of the disease was due to the patient being half-starved at home it was determined to admit her This was done, (p 80) liberal diet with beer and quinine was ordered, and all specific remedies disused After she came into the hospital rapid improvement ensued The vascularity of the cornea subsided, and what had threatened to be an interstitial abscess was gradually absorbed

I append to this case a wood-cut* representing the girl's upper front teeth. They were very peculiar indeed, in respect to the extreme irregularity of size and the smallness of several of them. They are not, however, by any means so typically characteristic as those shown at pages 82* and 83*, in which the central incisors are symmetrically dwarfed and notched. So acute an inflammation of the corneae as occurred in this instance I have never before witnessed in connection with hereditary syphilis. The girl's feeble health and under-fed condition, taken together with the exhibition of mercury in such doses as to be a powerful depressant, ought probably to be made to explain this unusual severity.

Case XLIX—Double chronic keratitis—Characteristic teeth—Syphilis in the father, etc.

Mr H. brought his eldest son to me, in March, 1859, on account of an attack of interstitial keratitis which affected both eyes. He was fifteen years old, and not particularly cachectic looking, though contrasting strongly with the appearance of robust health presented by his father. His nose was somewhat expanded, his face pale and showing small pits in several places. The state of the eyes was characteristic, the layers of the corneae being the seat of numerous small masses of white deposit and crescentic fringes of vessels being seen in both creeping up from below over the lower segment of its surface. His teeth were as characteristically dwarfed and notched as any I have ever seen

His father at first denied any syphilitic history, but on (p 81) being pressed admitted that he had before marriage contracted a chancre He had himself lost one eye, and on examination I

^{*} The wood cuts referred to have not been reproduced The condition illustrated is similar to that shown in the plate which is reproduced in this number E C K.

found that the pupil was closed by lymph exactly as if from a neglected attack of iritis. The inflammation had, he stated, occurred spontaneously at the age of twenty. In accordance with my request at the next visit another of his children was brought. She was a girl three years younger than her brother. Her left pupil was partially closed by adhesions as if from iritis in infancy, and she had a convergent squint and oscillation of the globes, her teeth were small and notched, but not so remarkably so as her brother's. I examined the teeth of both parents, but neither of them presented any peculiarity as to form, etc.

August 1st—This lad has remained under my treatment for three months. The attack proved a most severe one, and for some weeks rendered him quite blind. Latterly the clearing has been rapid, and he can now see fairly. The remedies used have been mercurial inunction and the iodides of potassium and iron internally, with occasional blisters behind the ears and a liberal diet.

Case L—Remains of chronic keratitis—Characteristic physiognomy and teeth—History of infantile syphilis

William F, aged 10, the youngest of three living children, having lost no fewer than eleven brothers and sisters in infancy Of those living, one a girl, now aged 13, attended at this hospital in childhood for what her mother says was "a cataract," but which she admits that the surgeon who saw the child considered to be due to venereal disease. The boy himself when an infant had severe snuffles, a sore mouth, and a sore anus. He was a fretful ailing baby and "always had something or other the matter with him". His mother denies having ever herself had any form of venereal disease, but admits that several other medical men have made the same accusation as myself both respecting herself and her children.

The boy comes on account of the remains of chronic (p. 82) keratitis in both eyes, resulting from an attack which began two or three years ago. The corneae are thinned, bulged, and still slightly opaque. He is pale and cachectic. His teeth, of which the central upper incisors are here shown, are most char-

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acteristic It will be seen that the teeth converge towards each other, are very short, have a vertical notch or cleft in their free edges, and that they are also very narrow from side to side at their edges, not being so wide there as at their necks. These peculiarities are those the most suggestive of hereditary syphilis, and are usually seen only in the upper central incisors

Cases LI and LII—History of chronic keratitis in a brother and sister—Characteristic physiognomy and teeth—all the symptoms best marked in the elder of the two

John A and his sister Elizabeth, aged respectively 7 and 14, were admitted on February 28th, 1859 In both the peculiar physiognomy was well characterised, so much so that I had recognised it before seeing their eyes. In the sister (i.e., the elder child) all the peculiarities were much the more marked, she was very hoarse, and had large cicatricial fissures extending from the angles of the mouth. At the age of seven her eyes inflamed and were affected severely, and for many months, the corneae had now nearly regained their normal transparency. In the boy the attack is but just passing off, having occurred quite recently, and having been much less severe than his sister's. The girl's teeth are exceedingly small, being peg-shaped, with wide interspaces, whilst her brother's are large and only differ from those of health in being more deeply serrate. No history of infantile ailments could be obtained.

Case LIII—Double chronic keratitis—Recovery under specific treatment—Characteristic teeth

Frederick S, aged 11, was admitted with double keratitis (p 83) in August, 1858 Specific treatment (iodides, and mild mercurial inunction) was adopted, and the disease never advanced to a very severe stage. In March, 1859, he was discharged well, both corneae being quite clear. His aspect was not particularly characteristic, but his teeth were so typical as to warrant a very strong opinion.

The appended wood-cut shows his central upper incisors which almost exactly resembled those figured in the preceding

case (See case L) I was not able to see any one from whom information as to infantile symptoms could be obtained, and the following is therefore a very important corroborative fact. His elder brother, aged 13, had his teeth much more extensively affected, and his physiognomy was also very characteristic. He had never had inflamed eyes, but had been very short-sighted from birth.

Case LIV.—Severe double keratitis—Typical teeth—Eyes permanently damaged

Mary Ann H, aged 19, a tall well-grown girl, whose face, excepting that the skin is pale, flabby, and greasy, exhibits scarcely any of the marks of the herdito-syphilitic diathesis, has been attending as an out-patient at the hospital for nearly three years past I have watched her case with great interest, as it has exhibited the course of chronic keratitis in a typical and severe form. Commencing in the left eye, and soon afterwards attacking the right also, both corneae were in the course of three months rendered so opaque that she was practically blind The amount of lymph effused into the corneal structure was very great, and assumed in both a peculiar pink tint, quite different from that caused by the encroachment of crescentic fringes of capillaries over their surfaces The corneae became also considerably misshapen, and there appeared at one time very little hope that any degree of recovery would ever ensue For upwards of six months she required to be led about as a blind person (p 84) About nine months from the onset, however, the process of gradual clearing became established, and although it proceeded very slowly, yet an extent of recovery has now taken place far beyond what had been hoped for With her left eye she can at the present time see to read, and only certain thin films of opacity remain visible In the right cornea there is still a large white opacity which will probably be permanent

This case has not been under my own treatment, and during the first year no specific treatment was adopted, tonics and repeated emmenagogues being alone resorted to Indeed we

were misled by her not presenting the usual physiognomy of hereditary syphilis, and thought that the case might probably prove an exception to the general rule At that time we did not place reliance on the condition of the teeth as a symptom, and were not much in the habit of inspecting them. As may be supposed, it was therefore with great interest that I found, on looking into her mouth for the first time a year subsequent to her admission, that her teeth showed most unmistakable marks of the syphilitic impress The upper incisors were in particular deeply notched, short, and of bad colour. To those who place the same reliance upon this symptom that I do the case was now placed almost beyond doubt, since I regard the coincidence of notched upper incisors and chronic interstitial keratitis, as sufficient to establish a very strong suspicion of hereditary syphilis despite the absence of a corroborative family history present instance the only facts as to the family which could be got at were the following.—Her mother, whom we had often seen, was a stout healthy-looking woman, she had borne fifteen children, of whom no fewer than eight had died in infancy (one in consequence of an accident). The patient M. A. H. was her second, and the oldest, a boy, is living and reported healthy. No direct questions were asked.

Case LV—Unusually severe attack of double keratitis (p 85) affecting the deeper layers—Complete blindness—Characteristic physiognomy and teeth.

The following case exemplifies a condition occasionally seen in the course of chronic keratitis which differs remarkably from the more ordinary ones. I have, as yet, only witnessed it in two or three instances, and have had no opportunity of watching its mode of production 10 In the stage under which they have hitherto come under observation the cornea retains its form, and its surface and superficial layers are quite free from vascularity and from morbid deposit Moulded, however, behind it,

¹⁰ Being in the constant habit of employing specific remedies from the first, my belief is that I never shall in my own practice witness the production of this stage of things

and probably also occupying its posterior layers is a dense grey white mass, in which vessels are easily seen ramifying, and by which every part of the iris and pupil are wholly concealed The appearance is very peculiar, and differs from that of any other form of leucoma that I have ever seen The opaque organized lymph being exactly coextensive with the cornea is evenly convex in all parts, and the transparency of the most superficial layers of the latter permits its structure as well as its form to be observed in detail Is it simply that the anterior chamber is filled with lymph which has been moulded at the back of the cornea? I have often asked other experienced ophthalmic observers to look at such eyes and tell me whether the cornea or the anterior chamber was the location of the opacity, but hitherto without getting at any trustworthy conclusion. It is indeed impossible from mere external inspection to arrive at an opinion, my belief is that the posterior layers of the cornea, and its posterior free surface are both affected by the deposit, but the iris usually escapes At any rate the most wonderful clearing away sometimes takes place, and then the iris is seen to have preserved its original colour, etc., in a way which it could not have done had it been once involved in a mass of organized (p 86) inflammatory product The condition, as I have witnessed it, is symmetrical, and the patient is, of course, quite blind for the

Joseph R, aged 14, of stunted growth and of most characteristic physiognomy, was admitted in December, 1858, his eyes being in the condition just described. He could but just tell light from shadow, and some friends were making interest to have him admitted into a Blind Asylum. He had been treated hitherto at another hospital, and in each temple were large unhealthy sores, with swollen everted edges, the results of the irritation of setons

He had taken cod-liver oil and tonics, but had had no specific remedies. The attack had commenced in November, 1857, and developed rapidly in both eyes, with much lacrymation and intolerance of light

From his mother I obtained the following history of her family Her eldest child was living and in good health Before the birth of her second child she had sores on the genitals, which were followed by a sore throat Her second child suffered severely from syphilis, and was seen by Dr Davis and Dr. Rees, both of whom gave unqualified opinions as to the nature of its ailments This child subsequently had inflamed eyes, and one of them is still "bad" The third child, now aged 16, also suffered from a prolonged attack of inflammation of her eyes, and still has very imperfect sight. This child, when three weeks old, was attacked by undoubted symptoms of hereditary syphilis, and was long under medical care on account of them patient, Joseph R, is the fourth of the family, and also suffered from suspicious symptoms in infancy. He has one younger sister, who is reported to be healthy His mother has lost only two, one of which was a stillbirth and the other died of brain disease at the age of ten weeks

Case LVI—Permanent opacities after a severe attack of interstitual keratitis—Characteristic physiognomy and teeth

Louisa W, aged 17, a pallid girl of flabby tissues but (p 87) well grown, was admitted under Mr Dixon's care nearly three years after the first onset of the disease The attack had evidently been a most severe one, and had left large permanent opacities in both corneae which greatly interfered with sight In the right eye Mr Dixon performed an operation for displacement of the pupil in order to bring it opposite a clearer part of Great benefit was obtained The condition in the cornea which her eyes are at present is probably exactly that to which those of Roxley (case LV) will arrive after a year or two right eye was the first attacked and the left soon followed was about three years ago She attended a surgeon who, according to her account, administered medicines which made her mouth very sore For six months she was so nearly blind that she could only just see the light Her aspect and teeth, the latter especially so, are characteristic of the diathesis

states that she is the fourth child and only living girl in a family of nine Six boys are living and reported healthy, two girls died in infancy

Case LVII—Remains of opacities from interstitial keratitis— Characteristic physiognomy and teeth—Deafness.

Archibald M'N, aged 13, a boy whose notched and stunted upper incisors and puckered angles of mouth sufficiently denoted his specific diathesis, was admitted on May 8th, 1859 Both corneae were extensively hazy from the effects of chronic keratitis. The disease had begun three years before, and had been so severe that for fifteen months, according to his own statement, he was blind excepting as to perception of light. He had attended at the Charing Cross Hospital throughout the whole time. He was the eldest child of three, and had not lost any brothers or sisters. The two youngere were aged respectively nine and four years. He had suffered from otorrhoea which had left him very deaf

(p 88) Case LVIII—Remains of opacity from chronic keratitis in the right eye only—Characteristic teeth and suspicious family history

William S, aged 12, from Yorkshire, was admitted on May 8th, 1859, of suspicious physiognomy and characteristic teeth. His mother stated that he had been very delicate when a baby, and that of four older than himself three had been dead-born and one had died in infancy. He had suffered from otorrhoea in childhood which had left him rather deaf. The left eye had never been affected, and its cornea was still quite clear. The right had been attacked by interstitial keratitis four years ago.

The upper central incisors presented a condition which I have never before seen. Although they had been cut for more than three years, neither of them had grown more than a line or two above the level of the gum. They were of very bad colour, and had notched irregular edges. His mother stated that the upper incisors of his first set had dropped out very early, and that for a series of years he had been without any. Only one brother was

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living (aged 6), and he had never suffered from inflammation of the eyes

Case LIX—Chronic keratitis in both—Disease of retina, etc— Characteristic physiognomy and teeth—History of syphilis in paients and of symptoms in infancy

Charles B, aged 26, of most characteristic teeth and physiognomy, was admitted for a second time in February, 1859. He had previously attended for a long time six years ago, probably for interstitial keratitis, but unfortunately no notes had been preserved. His cornea, although still extensively hazy, had cleared sufficiently to permit of an ophthalmoscopic examination of the deep parts which was made on account of his complaining that the sight of the right eye had recently failed. The media were seen to be hazy, as was also the retina, and the blood supply was decidedly below (p. 89) that of health, and the optic entrance was flat and sharply defined

His family history, as I obtained it from his mother, was that she had contracted the disease from her husband a few years before his birth. Prior to this she had borne several children, all of whom had been healthy. Her first child subsequent to the infection died with rash, etc., about the nates and other specific symptoms. The patient suffered severely from the same in infancy, and was not expected to have lived. Five younger children are living and fairly healthy.

Almost immediately after his second admission a rather sharp relapse of the keratitis occurred. Treatment by the inunction of mild mercurial ointment and the exhibition of iodide of potassium was ordered, and he made slow improvement during the several months that he remained under notice

Case LX—Double kerato-iritis—Characteristic physiognomy, etc Thomas H, aged 12, a boy from the workhouse whose "father is dead and mother run away," and respecting whose early history no information could therefore be obtained. He stated that he had one elder sister, and that she like himself had suffered from badly inflamed eyes for a long time. In himself the attack had

commenced two years ago, and had affected both eyes. The pupil of the left eye is almost occluded by the effects of iritis, and both corneae were extensively hazy. He is of marked syphilitic aspect, the nose being broad and sunken, and there being deep puckerings about the angles of the mouth and pits in the skin of the face. His teeth, instead of being stunted, are very large, but the upper incisors were marked by a furrow crossing their front surfaces. The left upper canine is not yet cut, but its right fellow, which has only been through for about a month, presents a most remarkable constriction (p. 90) near its apex. This constriction I have often seen near the apices of the canines, both in syphilitic and other patients, but never to such a remarkable extent as in this instance. The cases in which it has been most developed have all been syphilitic persons, and I therefore regard it as a suspicious though by no means conclusive condition

Case LXI—Bygone double keratitis—Characteristic teeth

The following case is one of peculiar interest to myself. In most of the others the patients have come under care on account of their eyes, and from observing the form of keratitis I have been induced to inspect the teeth. In this, however, my suspicions were aroused by noticing the teeth, and from the latter I passed to the eyes, there to find a full confirmation of my opinion that notched upper incisors and interstitial keratitis go together

Mary Ann W, aged 17, a well grown and moderately florid girl, applied to me at the Metropolitan Free Hospital on May 6th, 1859, on account of a sore under her upper lip. The whole lip was swollen, and the sore which was quite superficial had whitish borders. Although her aspect was that of a delicate girl, and her nose was rather abroad, I should certainly have suspected nothing had she not in raising her lip exhibited her upper teeth. The central incisors had a wide space between them and were stunted and notched. All the four canines showed the constriction near the apex referred to in the preced-

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ing case The incisors were indeed quite typical I at once looked at the eyes, and found both corneae slightly hazy throughout from the remains of interstitial deposit. The corneae were expanded and flattened in their centres, the anterior chambers were unduly large, and the irides of impaired lustre me that her eyes had been first attacked about four years ago, that she had attended a few months at an Ophthalmic Hospital, but getting rapidly worse had become a patient of the late Mr. Alexander, under whose care she remained for more (p. 91) than two years It was eighteen months before any material improvement occurred, and for four of that time she was so nearly blind that she had to be led about The right was the one first affected She had suffered in infancy from otorrhoea, which had left her rather deaf All that I could learn as to her family was that her mother had lost seven daughters during their infancy, and that two brothers, both older than the patient, now constituted, with herself, all who remained.

Case LXII—Double interstitial keratitis in a Jewess—Teeth notched and typical—History not obtained

Priscilla B, aged 15, a Jewess, from Portsmouth, was admitted in July 1859. Both corneae were affected with interstitial inflammation, the left having been attacked about three months and the right one month. Her central upper incisors were notched in a most typical manner. I did not see her mother, and consequently could obtain no history of infantile symptoms. I learnt, however, that she was the eldest of her family, of whom eight were living and three had died. One of these dead was older than herself

This case is the only one in which I have as yet witnessed interstitial keratitis in a patient of Jewish family. Prior to its occurrence I was in the habit of adverting to the fact of the rarity of this affection amongst Jews, as one which remarkably coincided with the theory of its syphilitic origin since, as I have elsewhere proved, syphilis is comparatively rare amongst that people

Case LXIII —Interstitial keratitis and typical teeth—History of syphilis in both parents and in the patient in infancy

The following case is of much value as bearing upon the degree of confidence which may be given to malformations of the teeth as indicative of hereditary syphilis:—

Charlotte S, aged 12, presented herself one morning (p 92) amongst other patients at my table at the Ophthalmic Hospital Her eyes were kept firmly closed on account of excessive intolerance, and as is not unfrequent under such circumstances, she was showing her upper teeth. Seeing that her upper incisors were notched, I examined them carefully. They were an exceedingly well characterized set, and presented the features which are roughly shown in the appended wood-cut. There was nothing very noteworthy in her physiognomy apart from her teeth. Her skin was rather flabby and pale, and the bridge of the nose was broad, but not remarkably so

I observed to the students who were looking on that the the teeth were so typical that I wished, for the sake of putting the value of that sign to the test, to pledge myself to the opinion, founded on their state alone, that the girl was the subject of hereditary syphilis

We now examined her eyes and found them both affected by interstitial keratitis in a well characterized form. I took her mother aside, and having put no other leading question to her beyond asking whether her husband was a healthy man, she spontaneously informed me that he had contracted the venereal disease fifteen years ago, and had communicated it to her. She was ill for at least seven months with it. At the time of her receiving it, she was two months pregnant. The child was born at the full time, and looked healthy, but wasted way and died at a month old. Her next conception ended in a six months' miscarriage, and the third in a similar event at the eighth month. Her fourth was our present patient who was puny and delicate in infancy and suffered from snuffles, etc. No subsequent births had occurred.

^{*}The wood cut referred to has not been reproduced. The condition illustrated is similar to that shown in the plate which is reproduced in this number. E. C. K.

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With regard to the keratitis in this case, it commenced in the girl's left eye, about six weeks before her admission, and in the right two weeks later. She is still under treatment, but already improving considerably

Case LXIV—Interstitial keratitis and typical teeth—Tertiary syphilis in the mother

The subject of the following case was a girl, aged 12, whom I saw casually in going through the wards of one of our larger hospitals The surgeon under whose care she was, was just dictating to his clinical clerk a diagnosis of "Strumous ophthalmia," when I remarked to him that the teeth were such as I was in the habit of considering characteristic of herditary syph-My observation would, I believe have been regarded only as an instance of hobby-riding had it not chanced that the girl's mother, who had, with her, been admitted that morning, occupied the adjacent bed The woman's scalp was seamed with the depressed scars of old nodes, and over her right shoulder, arm, etc, were large serpiginous ulcers, about the true nature of which there could be no doubt whatever She denied, however, having, even to her own knowledge, suffered from primary disease The nodes had occurred nine years ago patient was her eldest and only living child. Three younger ones had died in infancy

GENERAL COMMENTS AND SUMMARY

I have already remarked that the preceding series of 64 cases has a certain claim to a statistical character masmuch as I have, without selection, taken all the cases which have come under my notice. The desire to include all must be my excuse for recording several the data of which are very imperfect. In now proceeding to analyze it, my task divides itself naturally into three different parts. In the first place, I wish by the strict application of the numerical method to obtain a more closely accurate account (p. 94) of the disease known hitherto as "strumous corneitis," its symptoms, its usual course, and its ulterior results. Having thus sketched its natural history, I

shall ask the reader's attention to the statement of my reasons for believing that it is a direct consequence of hereditary syphilis, and occurs almost solely in the children of parents, one or both of whom has suffered from venereal disease. The question as to treatment will lastly come under notice, and I shall have to show that the prognosis may be materially bettered by the adoption of mild specific measures as opposed to the usual remedies for "struma"

- I Age.—It would appear that the greatest proportion of cases of this form of keratitis occurs in patients between the ages of 10 and 15. Thus we find that in nine instances the disease began before the age of 5, in eighteen between 5 and 10, in twenty-five between 10 and 15, in nine between 15 and 20, and in the remaining two between 20 and 25, the average age for the whole sixty-four being 10 It would appear to be comparatively rare in early childhood, and still more so subsequently to the full establishment of puberty I have never seen it commence in any one beyond the age of 25. With regard to several cases in the series in which it is stated to have begun in infancy, I feel some doubt as to the correctness of the history, as I did not see the patients until some years after the commencement of the disease No doubt the eyes were inflamed at the date assigned by the mothers of the patients, but whether the affection was from the first interstitial keratitis is open to some question, I have never myself witnessed its occurrence earlier than the age of two years (Case 20)
- 2 Sex—It would appear that girls are more liable to this disease than boys. Thus in forty-one of the cases before us the patients were females, and in twenty-three males, a ratio of I of the latter to I 8 of the former. This coincides with what I have ascertained respecting the acute iritis of syphilitic infants. Of the latter disease I am in (p. 95) possession of the particulars of sixteen cases in which the sex is specified, and of them twelve were female infants, and only four males
 - 3 State of health at the time of outbreak —In none of the preced-

¹¹ Ophthalmic Hospital Reports, vol 1 page 265

ing cases is it stated that the outbreak of keratitis had occurred during recovery from small-pox or any other exanthem, nor is there any note of other causes of ill health supposed to have acted as predisponents In none of the cases was there any reason to suppose the patient to be the subject of phthisis or other tuberculous affection, and amongst the coincidents "conspicuous by their absence" supposing the affection to be "strumous," is enlargement of the lymphatic glands. In only two cases did any affection of the cervical glands exist. On the other hand, the series presents very few exceptions indeed to the following statements. a That the patients were of peculiar pallor. In most the complexion was of a pale leaden or sallow hue, without a vestige of colour, and in none of the exceptional cases was there any degree of excessive floridness so commonly seen in the subjects of glandular struma b That the skin generally, and that of the face especially, was thick, coarse, and flabby. This condition is intended to be comprised whenever the term "syphilitic physiognomy" is used I have never employed the latter expression except to denote a striking and remarkable condition, such as would, from its peculiarity, have arrested the attention of the most cursory observer c That the bridge of the nose was wide and depressed This state also is included wherever the above terms have been used d That in the skin of the face there were numerous small pits and scars, and about the angles of the mouth the radiating scars of former ulcerations common non-specific eruptions of childhood, impetigo, porrigo, and eczema, leave no perceptible scars whilst their syphilitic congeners almost invariably do so Small-pox, chicken-pox, and herpes, undoubtedly do cause pits and scars which are undistinguishable from those of the syphilides The conjunction of fissures (p 96) at the oral angles with pits in the face, a history of no one of these three affections being obtainable, is, however, very suspicious e That, in those who had cut their permanent set, the condition of the incisor teeth was very peculiar, both in form, colour, and size As diagnostic of hereditary syphilis, various peculiarities are often presented by the others, especially the canines, but the upper central incisors are the test teeth When

first cut these teeth are usually short, narrow from side to side at their edges, and very thin After awhile a crescentic portion from their edge breaks away, leaving a broad, shallow, vertical notch (see figures, Cases 50 and 53), which is permanent for some years, but between twenty and thirty usually becomes obliterated by the premature wearing down of the tooth. The two teeth often converge, and sometimes they stand widely apart. In certain instances in which the notching is either wholly absent or but slightly marked, there is still a peculiar colour, and a narrow squareness of form, which are easily recognised by the practised In a considerable number of the cases cited no mention is made of the teeth, the notes having been taken before I was aware of the value of their structure as a symptom have made it a rule always to look into the mouth, however, I have not met with a single example of well characteristized interstitial keratitis in which the teeth were of normal size and Indeed there can be no doubt whatever as to the truth of the assertion that malformed upper incisors (permanent set) are all but invariably coincident with this disease. A few months' observation at any large Ophthalmic Institution will satisfy any one of this clinical fact

The following special affections were coincident with the keratitic disease. Large scars in the soft palate and pharynx in six instances. Deafness consequent on otorrhoea in eight Nodes in six (tibia four, radius two). Psoriasis on the face in four. Destruction of the nose by erosive lupus in three. Pains in the bones in three. Suppurated glands in the neck in two Laryngeal disease in two. Tinea tarsi in two. Swelling (p. 97) of knee-joints in two. Inverted eyelids in one. Lacrymal abscess in one. Cellular abscess in one. Exfoliation of alveolus of upper jaw in two.

4 Previous history, more especially as regards infancy In thirty-one of the cases, or rather more than half, a clear history of the occurrence of symptoms of inherited syphilis in infancy (rash, sore mouth, ulcers at anus, prolonged snuffles, etc.) was obtained. This number would probably have been much increased, but that in many cases I was unable to see the patient's

mother, or any one who could answer questions on this head In several, which I have not included in it, there was a history of one or more very suspicious symptoms, the group, however, was not sufficiently complete to allow of a confident opinion In eleven instances the mothers admitted that other of their children had also in infancy suffered from similar symptoms. In many of the cases in which I was unable to obtain a history or to make inquiry as to infantile symptoms, are those in which physiognomy, teeth, etc, were most typically characteristic The proportionate frequency of otorrhoea, ulceration of the palate, etc, has already been stated

- 5 History of syphilis in parents.—Those who have engaged in similar inquiries will feel no surprise at the fact that in nineteen cases only did I obtain from the parents a free admission that one or both had prior to the birth of the child suffered from venereal disease in a constitutional form. Of these, in twelve instances, the mother had been infected by her husband, and both were consequently diseased, in four the father was known to have had the disease whilst the mother averred that she had never suffered, in one the mother had had syphilis before marriage, and believed her husband to be healthy, and in the remaining one there was a statement (probably untrue) about the communication (p. 98) of the disease direct to the infant by a tainted nurse In thirty cases, or nearly half, I either had no opportunity of asking questions on this score of either parent, or did not avail myself of it In five instances syphilitic symptoms existed at the time that the notes were taken in one or other parent, and this number includes some in which, notwithstanding, all history of primary disease was denied. In two cases, in which I could obtain no confession, the mother admitted that other medical men who had attended her children in infancy had asked the same questions as myself.
- 6 Estimate of viability of the patients' family.—Very important information may be reflected upon many of the questions connected with inherited tendencies to particular forms of disease by data as to the mortality which has prevailed amongst the brothers and sisters of the subjects of them. If the rate of

juvenile mortality has been excessive there is ground for believing that the taint is of a kind which materially diminishes the vital power and predisposed to the attacks of fatal diseases. With the view of affording information on this point in relation to the subjects of interstitial keratitis I have compiled the following Table shewing how many children had been born in each instance, how many were still living, and the position of the patient amongst them, i.e., whether eldest, second, third, etc. The latter datum, as will presently be shewn, is of especial importance. Eleven cases are unavoidably omitted on account

(p 99) TABLE A

				1 337					
Case	Number born	Number living	Position of Patient	Remarks	Case	Number born	Number living	Position of Patient	Remarks
1	11	6	5th		32	8	2	Ist	
2	10	6	Ist		33	15	5	Ist	
3	10	6	2nd		34	5	5	3rd	
4	6*	5	Ist		35	13	8	Ist	
	7	5	2nd		36	9	2	ıst	Second family
5	10	2	ıst		37	7*	1	Ist	
7	4	2	ıst		38	7*	3	ıst	
8	7	4	Ist		39	10	4	ıst	
9	7	3	2nd		40	6	3	ıst	
10	11	3	ıst		43	1	I	ıst	
II	7*	3	2nd		45	7*	5	ıst	
12	7	3*	Ist		46	3	I	Ist	
13	6*	2	Ist		48	5	3	Ist	First born
14	7	I	Ist		49	5	3	Ist	First born
15	3*	I	ıst		50	14	3	3rd	
16	7*	7	3rd		53	7*	3*	2nd	
17	7*	4	3rd		54	15	7	2nd	
18	7	3*	Ist		56	9	7	4th	Only girl living
19	4	I	Ist		57	3 6	3	Ist	
20	5	3	2nd		58	6	2	Ist	
21	6	4	Ist		59	7	6	Ist	Previous family.
22	3	3	Ist		60		2	Ist	
26	4	2	ıst		61	10	3	3rd	Only girl living
27	3	3	Ist		63	4	I	Ist	
28	14	7	2nd		64	4	I	ıst	
29	II	5	Ist						
31	9	2	Ist						

of the needful history being wanting, and in several others I have supplied by a calculation of averages, numbers which must otherwise have been omitted. The numerals marked with an asterisk are those which have been thus supplied. In counting the number of children born to any one mother, I have included dead births, if at the full time. Miscarriages and premature births have been, of course, omitted

Thus we find that fifty-three mothers of subjects of interstitial keratitis (the latter being at the time of inquiry of the average age of nine and a-half) had borne families averaging seven in number, but which had been reduced by death to an average of 3.3. Fifty-three mothers had borne a total of 371 children, and of these only 179 remained alive. In other terms, fifty-three patients suffering from interstitial keratitis pass before us, and we find, on asking, that, taking one with another, they have all lost in early life more than half of their brothers and sisters. There can be little doubt, despite the many fallacies to which statistics expose us, that this rate of mortality is very high.

7. Position of the patient amongst his brothers and sisters. We have seen that the 53 families give us a total of 179 living children, an average of 3 3 to each family. Now, supposing the 179 children put together and a group of 53 drafted from them without any selection, this group ought to contain, of the eldest of their respective families, a proportion of only 1 in every 3 3. The subjoined tabular statement will show how different is the result in the cases before us, and will demonstrate that interstitial keratitis in choosing out its victims, has some principle which guides its selection

Of the 53 cases the patient was,

The Eldest in 38 instances, a proportion of 1 in 1.4

Second in 8 " " 1 in 6

Third in 5 " " 1 in 10

Fourth in 1 " " 1 in 53

Fifth in 5 " " 1 in 53

Thus it would appear, that not only does the disease select the eldest in a large majority of instances, but that it proceeds downwards by the same rule, preferring the second to the third, and so on This statement of fact, strong as it is, would be yet further strengthened if two sources of fallacy could be removed 1st, that in certain instances, the primary disease had probably been contracted by the parent after the birth of part of his family, and that thus the patient, although not the eldest of the whole, was the eldest of those born subsequent to the event alluded to—2nd, that in two instances in the series, both the eldest and the second child suffered from keratitis, and are included in the table

Why the first born should suffer most often, and most severely, from a disease consequent upon syphilis in the parent, we can easily understand, it is in keeping with all that we know respecting the transmission of that disease. On the "strumous" hypothesis, however, to the exclusion of inherited syphilis, I think I may fairly challenge any one to offer a shadow of explanation of the remarkable facts just adduced

(p 101) 8 Phenomena of the attack—The phenomena of interstitial keratitis have been well described by several authors I have given a brief resume of them in vol 1, page 232, and need not here attempt any lengthy description. The series under consideration, however, supplies us with several cases, in which less usual, and hitherto but little noticed, conditions were presented. The cases in fact divide themselves into four groups, according as one or other of the special symptoms of inflammation were apparent

Group A includes the more common cases, in which interstitial deposit, without any great degree of sclerotic or superficial vascularity, is the prominent symptom

Group B comprises those cases in which, in addition to the interstitial deposits of lymph, crescentic fringes of capillaries are seen spreading from the circumference over the surface of the cornea. These fringes usually commence at the lowest part, but subsequently encroach from all parts of the cornea, and often nearly, or altogether, meet in the centre. In the latter event, I have seen produced a remarkably vivid colouring of the whole surface 12. The degree of lacrymation and of intolerance of light,

¹² I have not as yet had any sufficient opportunity for observing keratitis in the Paris Hospitals, but, judging from certain terms of comparison employed by French writers,

present in any given case, will usually be found proportionate to the extent of these fringes

Group C has been described at page 85, and is illustrated by three or four cases only in the present series. In it there is a large effusion of lymph, in all probability from the posterior surface of the cornea, moulding itself in the concavity of the latter, and causing complete blindness. Hitherto I have never seen the superficial vascularity characteristic of Group B, coexistent with this state of things. After this form of disease, I suspect that the eyes are always more or less damaged permanently

(p 102) Group D has for its characteristic the punctate effusion of lymph, in circumscribed dots on the posterior layer of the cornea. This condition is often seen in iritis, consequent on acquired syphilis, it also constitutes a most characteristic feature of what is known as aquo-capsulitis, as distinct from interstitial keratitis. In a few cases of the latter affection however, it occurs as the first stage, to be followed sooner or later by more anterior effusions into the substance of the cornea itself

Although I have mentioned these varieties as distinct groups, yet it must be understood that they not unfrequently stand in the relation of stages one to the other. The more severe conditions included in Groups B and C are, for instance, rarely produced, without either those of A or D having preceded them

The occurrence of iritis, as a complication in cases of interstitial keratitis, although not unfrequent, is, I believe, far from being usual. The obscuration of the cornea is commonly so quickly produced, that it becomes impossible to inspect the state of the iris, after the first week or two of the attack. During that period I have very rarely indeed been able to detect any evidence of the iris being affected. On recovery, the pupil is usually quite round and mobile, though not unfrequently the iris structure itself has lost some of its lustre, and looks dull and leaden. I have very rarely indeed seen the pupil occluded. When iritis

should not be surprised to find that cases of this class are there in much greater proportion to those of the former than in England With us they are certainly rare

does occur, it is usually of very slight severity, and attended with but little tendency to effusion

In most cases interstitial keratitis affects both eyes, and with almost equal intensity. Both were involved in fifty-six of the sixty-four cases under consideration, in five the left alone, and in three the right alone. One of twenty-five, in which the notes inform us as to which was first attacked, we find the left to have been so in fifteen instances, and the right in ten. Of twenty-six, in which like information is given, as to which was most severely affected, it is the left in seventeen, and the right in nine. It would seem, therefore, (p. 103) that the left eye is the most often attacked alone, is most often the first to be affected, and usually suffers the most severely

As in most other symmetrical diseases, it is rare that the two organs are attacked quite simultaneously. The second is, I believe, usually affected from a few days to a few weeks subsequently to the first. Now and then, however, the interval is much longer. Thus in Case 43, a period of two years intervened, and in Case 31, one of four months. Case 26 is interesting as an instance of acute relapse in one eye, two years after the beginning of the attack, and when both had seemed to be nearly recovered. Several other instances of relapses, more or less acute, are scattered through the series, but they are decidedly exceptional. Ordinarily, when once the process of clearing has set in, it is remarkable how steadily it advances

I will now place in concise juxtaposition the chief reasons which induce me to regard interstitial keratitis as a direct result of inherited syphilis

1st From its being a very well-marked and peculiar form of disease, it is *a priori* probable that it acknowledges some single and definite cause

2nd Its subjects are almost invariably of very peculiar physiognomy, and usually bear the most marked similarity to one another

3rd Its subject almost invariably have their upper central incisor-teeth of the permanent set dwarfed and notched in a peculiar and characteristic manner

4th In most cases the features alluded to under the last two heads bear no resemblance whatever to those of "struma" properly so called The subjects of true struma, on the contrary, usually have large white teeth, and often florid complexions

5th I have not yet seen a single case in which the patient was the subject of phthisis, and very few in which enlargement of the glands of the neck had occurred

6th It affects by preference the eldest living child of the (p 104) family, a circumstance to be expected under the syphilitic hypothesis, but wholly inexplicable under that of struma

7th It affects female children in preference to males, and occurs in families in which a large infantile mortality has usually occurred

8th It occurs in all classes of the community, the well-fed and under-fed, and the residents in the most healthy situations (sea-side, etc.), as well as those of crowded cities

9th. In nineteen out of thirty-one cases in which I was able to make inquiries on the subject, I obtained a confession that one or other parent had suffered from constitutional syphilis prior to the birth of the patient

10th In thirty-two instances out of thirty-eight in which I obtained information as to the health of the patient during early childhood, a clear history of the usual symptoms of infantile syphilis was given

11th In eleven instances there was a clear history of symptoms of infantile syphilis having been observed in brothers or sisters of the patient

12th Whilst, as above observed, enlargements of the lymphatic glands (two cases) are unusual, other affections far more closely connected with syphilis than with true struma, such as nodes (six cases), ulceration of the palate (six cases), and erosive lupus (three cases), are not infrequent in the subjects of this disease

9 Treatment

The treatment which I usually adopt consists of the cautious use of mercurials and iodides, at the same time supporting the system by tonics and a liberal diet The mild mercurial ointment

rubbed in behind the ears, in the neck, or under the axillae, every night at bedtime, is the best mode of employing that agent, and one which in these cases I never omit A mixture containing iodide of potassium, iodide of iron, and tincture of nux vomica is also usually prescribed at the same time. If the patient be very feeble and if the case be one belonging to group B (page 101), that is, with much superficial vascularity, more direct tonics, such as quinine and the pyrophosphite of iron, are indicated The induction of ptyalism ought certainly to be avoided though in one instance I witnessed most rapid improvement coincident with its occurrence (Case 12), yet I feel sure that it is unwise to run the risk of so much reducing the patient's strength Unless, indeed, the surgeon is certain that his patient is well fed and well protected from cold, the utmost caution ought to be used in ordering mercury In case 48 a rapidly induced ptyalism in a half-starved feeble girl certainly did harm. If the intolerance of light be great the occasional employment of blisters behind the ears may do good, but some of the worst cases I have seen had become so in spite of setons which had been introduced into the temples To cases 14, 31, and 49, I would appeal in proof of the superior efficiency of a combined tonic and specific plan of treatment over a merely tonic one I had at first intended to attempt a detailed comparison of the two modes, but on further examination of my data am reluctantly induced to content myself for the present with the above observation

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INFLAMMATORY OPACITIES IN THE VITREOUS BODY, LENS, ETC.

That in the form of inflammation of the eyeball which results from acquired syphilis the choroid is not unfrequently affected, has been placed beyond all doubt by the introduction of the ophthalmoscope. White patches of lymph may, by its aid, frequently be seen occupying various positions in the fundus of the eye, and their removal may often be effected by mercurial treatment. That these deposits are in the choroid coat is proved by the fact that the retinal vessels may usually be seen upon their surfaces. The inflammation however by no means confines itself

to the choroid. A condition of general cloudiness is sometimes observed, which can be explained by no other hypothesis than that the delicate framework of the vitreous itself is the seat of inflammatory deposit In fact, syphilitic ophthalmitis, although most frequently met with as a form of sclero-iritis, may involve any one or all of the different structures of the eyeball 13 This, then, being the state of things in the acquired syphilis of adults, we might conjecture that nearly the same would be observed in the inherited disease of children,—and such is indeed the fact Were it not that in them the choroiditis most often occurs, either with or (p 259) after an attack of keratitis, I have no doubt that it would be much more frequently noticed. It is the hazy state of cornea which not seldom prevents an ophthalmoscopic inspection and also furnishes an apparent explanation of the impairment of vision Every now and then, however, we meet with examples of choroidal disease of this type, in which either the corneae have escaped or have cleared sufficiently to allow of examination In such the disease may be traced through several distinct stages The first of these is characterized by much dimness of vision, and by the presence of diffused patches of lymph, the retina being hazy and not unfrequently the vitreous also After a while the sight improves and the patches are more defined, and in the third stage, that of cure, they are seen abruply circumscribed and unattended by any general swelling of the adjacent tissue The cases to follow exemplify chiefly the two latter stages of the disease Although, as I shall have to show subsequently, the changes chiefly involve the choroid, yet I have no idea that they are always limited to it Even if they were, it could scarcely be expected but that the overlying retina should also suffer in some degree The degree of vision, which the subjects of most extensive choroidal disorganisation of this kind often retain, is however proof that the retina is but slightly and secondarily involved (See Case III, Charles M)

It must not be supposed that the form of disease is invariably of one type, for although in most instances such is the case, in a

¹³ To Dr Jacob, of Dublin, much credit is due for the strenuous assertion of this doctrine many years ago

few remarkable deviations occur The first case which I shall adduce is one in which the effusion was unusually extensive

Case I—Hereditary syphilis—Free effusion of lymph into the choroids of both eyes.

Frederic C B, aged 17 months, was admitted in December, 1857 His mother stated that she had suffered from sores. followed by a rash, soon after marriage Of her first (p 260) three infants, two had been born dead, and one had died soon after birth, the patient was her fourth, and the only one now At the age of three weeks he had "dreadful snuffles" and discharge from the nose, and although at first a fine baby, rapidly fell away to a miserably puny one When three months old a rash broke out, and the mouth and nates became very sore He was not treated by a physician for inherited syphilis, and had mercury freely given, with the result that all external symptoms passed away When his mother brought him to the Ophthalmic Hospital, it was on account of her fear that he was going blind She had noticed that his eyes rolled about much, and had fancied she saw "a white skin" on the left The child now had a clear skin, but there were puckered scars at the angles of the mouth, his teeth were small, of bad colour, and very irregular, and the bridge of the nose was sunken Even without the use of the ophthalmoscope, it was easy to see that a yellow white substance occupied the fundus of the left eye Both irides were perfectly clear, and there was no sclerotic congestion Light was borne well, and both pupils were fairly active Atropine having been used, it was seen with the ophthalmoscope that an extensive layer of lymph was smoothly spread out over almost the whole of the central part of the choroid, comprising as much as could be brought into view at once No vessels were seen on its surface, and the presumption, therefore, was that either it was upon the retina, or, more probably, that it had led to its destruction Its smooth surface opposed the idea that it had been effused free into the cavity of the globe In the right eye numerous white spots of lymph were seen, but the retina itself was not disorganised, and the entrance of the optic nerve was distinct and

normal The infant, as far as could be ascertained, was all but sightless The iodide of potassium internally, and mercurial inunction were prescribed; but, owing to the mother's irregularity of attendance, the treatment was very imperfectly carried out

On June 18th, six months after admission, the notes state (p 261) that "he can see with the right better than he did, but only very imperfectly In it the spots remain in statu quo, and are still plainly visible. In the left the large patch of lymph is more easily seen than it was because it has become much whiter and more glistening. As to prominence and exgent it is much as it was "

Case II—Large cicatrices in the choroid of the left eye—Teeth and physiognomy typical of hereditary syphilis

For permission to make use of this case, I am indebted to Mr Dixon, under whose care the boy was Charles H, aged 14, from Croydon The lad was brought to the hospital on account of very defective sight in the right eye His left eye had almost perfect sight, and he could read easily On examination with the ophthalmoscope, numerous patches of various shades, from red and pink to white, were seen beneath the retina One of these which was nearly circular, very much resembled the optic entrance, and excepting for the absence of vessels, might easily have been mistaken for it By the margins of the white patches, were many small masses of pigment. The right eye diverged considerably, and he could see but very little with it His mother stated that he was her only child, and that in infancy he had suffered severely with rash, thrush, snuffles and sores at the anus These symptoms the medical man who attended him had said, were "due to disease derived from her father" His mother had had one miscarriage prior to his birth, but had never since conceived, although now for six years married to a second husband The boy's aspect and teeth were most characteristic He was of bad complexion, and had psoriasis on the face The affection of the right eye was believed to date almost from infancy the choroidal changes were evidently those of long passed and now retrograde disease, Mr Dixon did not adopt any treatment

Case III.—Extensive cicatrices in the choroids of both eyes— Physiognomy and teeth suspicious—History suspicious

Charles M, aged 20, a pale cachectic lad came under my care. with a written memorandum by Dr Bader, who had previously seen him, "specific changes in both eyes, of six years' duration." The ophthalmoscope showed abruptly circumscribed patches, of a dead white colour, on various parts in the fundus of each eye. In both, the retinae, where not involved by the patches, were very pale, and the optic entrances were irregular. The patient notwithstanding these changes, stated that he was still able to work as a shoe maker, though he could see but very imperfectly. His physiognomy was very suspicious, and his teeth, although by no means typical, were small and much worn down There were fissures extending from the angles of the mouth was dead, and was reported to have been a dissipated man, although as far as his mother knew, neither had he or she ever suffered from venereal disease His mother had borne sixteen children, of whom he was the only one now living brother, who had died at the age of seventeen, had attended this hospital with "bad eyes," for many months

Case IV—Hereditary syphilis—Interstitial keratitis, with cataract, choroiditis and iritis—Complete loss of vision in one eye—Excision of the glove and subsequent examination

Mary Ann R, single, aged 21, under the care of Mr Poland, during 1859 and 1860. Her aspect was most characteristic of hereditary syphilis. Her teeth, both upper and lower sets, were horizontally notched and most extensively deformed, but the upper incisors (the test teeth), had been so much broken away by caries, that their vertical notches were scarcely recognizable. Her right globe had been excised by Mr Poland, having been disorganized (p. 263) and rendered sightless, by the results of syphilitic choroiditis, etc. It appeared from her history that she had had a cataract in this eye. At another hospital four operations had, she said, been performed for the removal of the cataract. (See Dr Bader's Report below.) Her left cornea had opacities in its structure, and the pupil was adherent at

two or three points She could just manage to see to read, but only with difficulty It appeared that she had had excellent sight, up to the age of 17, when an attack of inflammation occurred, in which both eyes were involved, and which rendered her blind for some weeks She was the eldest living in her family. The first infant had died at three days' old Two younger than herself, and aged respectively, 20 and 17, were living, and reported to have good eyesight

The following account of the ophthalmoscopic examination and of the dissection of the globe after excision in this case, has been obligingly supplied to me by Dr Bader. I am not aware that any other opportunity of examining after removal the exact state of the choroid, retina, etc., in this form of disease has been obtained. The report is, therefore, peculiarly valuable.

Report of the state of the eyes at the date of the excision

LEFT EYE—Portions of the cornea are slightly misty; its convexity is increased, the anterior chamber is large, the iris has the peculiar steel-blue colour, several posterior synechiae exist but interfere only slightly with the activity of the pupil With the ophthalmoscope the optic nerve is seen to be of a graypink colour, as is frequently observed in similar cases, the coats of the fundus are thinned, and staphylomatous near the optic nerve

Portions of the choroid are sprinkled with minute black dots. The sight of this eye, considering the state of the cornea, (p 264) pupil and fundus, is good. The eye is irritable from sympathy with its fellow.

The RIGHT EYE had no perception of light

The iris could only be seen here and there, owing to the extensive opacity of the cornea, and, where seen, was in apposition with the latter. The greater part of the cornea was replaced by opaque tissue, portions of which were staphylomatous

The tension of the eye was normal It had occasionally been painful and red since vision was lost, and during the last month there had been constant pain and inflammation. The eye was excised by Mr. Poland and was immediately examined

It was generally enlarged, but the transverse diameter exceeded the anterior one

The anterior surface of the rotten and atrophied iris was adherent to the tissue which replaced the cornea, and was in apposition with the translucent portions of the cornea. The opaque thickened suspensory ligament was adherent to the posterior surface of the iris, the thickened, empty lens capsule adhered to the pupillary margin and to the tissue which replaced the cornea

The vitreous space was occupied by a chocolate coloured turbid fluid, which consisted of debris of the framework of the vitreous humour, of blood-corpuscles and of a highly albuminous fluid

The inner (vitreous) surface of the membrane, which intervenes between that part of the choroid known as the ora serrata and the vitreous space, was sprinkled with smaller and larger gray opaque patches of fibrous tissue The choroid surrounding those patches and the neighbouring ciliary processes were edematous.

The retina was in apposition with the choroid, it was slightly hazy, but admitted of a good view of the choroid. Minute grayish-white and yellowish opaque dots were seen in its substance, especially round the optic nerve. The optic nerve itself and the yellow spot appeared healthy

The choroid appeared much thinned, and was of a pale brown colour. Its retinal surface was sprinkled with minute, black, roundish spots, these were most numerous on the portion situated between the equator of the eye and the ora serrata. Some of these spots projected from the choroid, but without affecting the surface of the retina. Portions of the latter remained adherent to the choroid when pealed off, this occurred chiefly to those portions of retina which were situated over or near the black spots.

Microscopic examination of the diseased tissues

a — The choroid and the hexagonal cells

The stellate pigment of the choroid and the large choroidal vessels offered no peculiarities

Numerous clusters of cells were deposited round the capillaries and round those of the larger choroidal vessels, which are near

the elastic lamina, these clusters had a roundish shape. The cells were of crown-glass colour and strongly translucent, being in size somewhat larger than blood corpuscles. Some of the blood vessels were entirely surrounded by cells, others only on the side nearest the elastic lamina. The latter had in many places disappeared, and the cells had passed through the gaps and occupied the place of the adjoining rods, these latter were in other places distorted, bent, etc., by similar clusters of cells

In no instance had these cells passed beyond that part of the retinal framework.

The cells were in immediate apposition with each other, and separated from the surrounding parts by a thin layer of obscurely fibrillated tissue, the fibrillae are lost sight of in the surrounding pigment of the choroid, in the retina they mingled with the rods

The margins of the apertures in the elastic lamina of the choroid were thickened by a tissue similar in appearance and transparency to that of the lamina

(p 266) The hexagonal cells appeared normal, except those over portions of choroid which were occupied by clustered cells, and except those which immediately surrounded the apertures in the elastic lamina

The former had lost their hexagonal shape, they were rounded off, and their pigment granules, instead of being of a pale brown colour as the remainder, appeared, some deep brown, others black, which, seen with the naked eye, gave the choroid the appearance of being sprinkled with black dots. The latter were heaped up round the apertures in the elastic lamina, they were round, and their pigment granules were black, at many places these cells had been displaced among the rods.

The clusters of cells were most numerous in the portion of choroid at the equator of the eye, the choroid round the optic nerve and yellow spot appeared healthy

b—The retina

The framework of the retina, the rods excepted, appeared not changed, the latter were, as above mentioned, displaced, distorted, etc., by the morbid products emanating from the choroid

Many of the loculi, formed by what are called the radial fibres, were empty, others were occupied by healthy looking cells, others were filled with what appeared to be oil globules

The greyish white and yellowish opaque dots, seen in the retina with the naked eye, were due to these accumulations of oil (?) globules in the loculi of the retinal framework

The place of the delicate cell-layer, immediately beneath the optic nerve fibres, was occupied by an amorphous molecular greyish deposit

The walls of the retinal blood vessels were thickened

The layer of true optic nerve fibres which overlays the retina appeared healthy.

Case V.—Entire loss of vision in both eyes in a boy, the undoubted subject of hereditary syphilis—Ophthalmoscopic examination wanting

Edward W, aged 10, of fairly healthy aspect, but pale. Bridge of nose rather broad, and some psoriasis about the skin of face. The incisor teeth were not notched, but of very peculiar form, being so much narrowed laterally, that they almost resembled canines. Their form was such that, despite the boy's healthy aspect, and the absence of notches, I at once suspected the true nature of the case.

The history was, that in infancy he had had purulent ophthalmia, after recovery from which, however, he enjoyed perfect sight, and retained it until a year ago. The left eye began to fail first, and subsequently the other; and after a few months he became, as he was when these notes were taken, totally blind. On inspection, the left pupil was seen to be much larger than the other, and both were very sluggish. There was not the least congestion about any part. His tonsils showed cicatrices, and were atrophied. His mother stated that she had had syphilis soon after her marriage, and had suffered severely from it

I have unfortunately mislaid my notes of the ophthalmoscopic examination in this interesting case, and, not knowing the boy's address, am unable to complete the account It may be con-

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1ectured that both eyes were in the condition illustrated by the left in Case I.

Case VI—Numerous cicatrices in the choroid—Syphilitic

physiognomy and teeth—History of infantile symptoms

Charles D., aged 9, the second of three living children (a fourth having died), attended under Mr. Bowman's care during 1859 His mother denied all history of syphilis, but she did not appear to speak openly, and against her denial were the following facts In infancy he had (p. 268) suffered from bad and prolonged snuffles, attended with a rash in the body, for the cure of which the late Mr Gossett ordered a small pill night and morning for many months (probably mercury) His mother stated that he took the pills almost continuously for nearly two years aspect was characteristic, nose very much sunken indeed; head large, teeth separate, narrowed, and slightly notched (quite typical).

In both eyes the ophthalmoscope showed numerous round patches in different tracts of the retina, of various sizes, quite white and glistening Around many of them was seen a minute crescent of iron-black pigment The patches were totally destitute of vessels The retina on other parts was paler than normal, and as if thinned In many large, ill-defined patches, slender networks of vessels, were seen coursing over surfaces destitute of pigment, and looking as if on paper In each eye the cornea, lens, and vitreous body were perfectly transparent, and allowed

of the deeper structures being very clearly seen

The boy had great difficulty in directing his eyes, and there was a slight squint, but he could see sufficiently to have learnt his letters He always looked sideways at anything he wished to see-never straight

The history of his eyes was that in infancy he always had a peculiar rolling motion of the globes, and did not appear to see well On account of this symptom many surgeons were con-No external inflammation of the eyes ever occurred. It thus appeared probable that the choroiditis dated back from early infancy, about the age when iritis usually occurs Very possibly the boy may, in the sequel, suffer from keratitis.

Case VII —History of hereditary syphilis—Numerous cicatrices in the choroid of the right eye

Samuel B, aged about 12, of fair complexion, and characteristic aspect His four upper front teeth were all (p 269) out, the canines and lower set presented as marked features as are ever seen in those teeth, being remarkably peg-shaped and notched His mother had borne six children, of whom three had died, Samuel B being the second of those living When an infant, he attended the hospital on account of inflamed eyes, the attack, according to his mother's description, not having been one of purulent ophthalmia He had at that time bad snuffles and a troublesome rash on the body, as well as a very sore mouth His mother stated that she had contracted syphilis from her husband subsequent to the birth of her second child, and that, although treated by mercury, she had suffered afterwards from ulcerated sore throat and rash All her children born since had had specific symptoms in infancy, excepting the last The sight of the boy's right eye was all but lost The ophthalmoscope showed many circular white patches, not a few of which had black dots in their centres The patches were of glistening white and the choroid and retina appeared to be wholly disorganised and absorbed at these parts. No note, as to their condition, was taken July 8, 1859, unfortunately it is very incomplete, and I have no mention of the state of the other eye

Case VIII—Hereditary syphilis in a severe form—keratitis in both eyes at the age of two years—Entire loss of sight in the left from choroidal disease at the age of twenty

Emily H, aged 23, bearing the physiognomy of hereditary syphilis most unmistakably, came under my care in January, 1859 She had often been a patient at the hospital previously—indeed, almost the whole of her life. The bridge of her nose was sunken and broad, there were large cicatrices at the angles of the mouth, and many pits in the skin of the face and forehead,

the skin itself being thick, oily, and of bad tint. Her teeth were small, peggy, of bad colour, and the upper incisors notched Her tonsils were wasted, and she was somewhat hoarse mother told me that she (p 270) was separated from her husband on account of his having several times given her venereal diseases, from which he had himself suffered very severely Emily H was the only one now living, and the eldest born Two born subsequently had died (the first of hydrocephalus, under the care of Dr Conquest, the second "of consumption," much wasted, at the age of nine months) In infancy she had purulent ophthalmia, and bad snuffles, a rash over the body, and a very sore mouth She was treated for hereditary syphilis, and subsequently, when two years old, she was for three months under Mr Scott's care at the Ophthalmic Hospital, for what, from the history would appear to have been keratitis She recovered so far from this as to be able to learn to read, but her sight was ever afterwards much impaired About eighteen months ago her left eye began to get rapidly worse She had severe, long-continued, and deep-seated pain in the globe, and after the lapse of a few weeks was so blind that she could but just perceive the window At the date of my note she could not detect the shadow of a hand passing before the eye The cornea was bulged and hazy the pupil dilated and fixed She had been accustomed to see black muscae floating before it, whilst she retained sufficient power of vision to perceive them

Case IX—Strabismus, cataract and partially adherent pupil after an attack of kerato-iritis—Typical teeth

Elizabeth G, aged 20, the youngest but one of a family of five This patient was admitted on June 30th. With her right eye she could see to distinguish large objects, and could even read large print. Its iris was of steel-grey tint, concave and partially adherent at its pupillary margin, but fairly mobile. There was a semi-lunar portion of opaque membrane visible just within the area of the pupil in its lower part. Her left eye was slightly divergent and prominent. Its pupil was wholly excluded by adhesions (p. 271) and immobile. Its area being occupied by

greyish white glistening material, evidently the remains of disorganized lens

The history given was, that she had enjoyed perfect sight up to the age of nine years, when during an acute attack of inflammation (keratitis?) she was blind for six months. This slowly passed off and left her sight much impaired. Her corneae had now so far cleared that only a few interstitial films were visible. Her teeth, both upper and lower sets, were narrow, peg-shaped, and quite typical of hereditary syphilis. I had no opportunity of obtaining any history of her infancy, but my notes state that both Mr. Dixon and Dr. Bader fully agreed with me in considering that the diagnosis of hereditary syphilis was established

Case X—Cataract, with disease of the vitreous body and deposits in the retina—Physiognomy and teeth typical as regards hereditary syphilis.

Caroline G, aged 13, was admitted as an out-patient on October 14th, 1858 I saw her for the first time on March 10th, 1859 Her hospital letter had the following note on it, written by Dr. Bader, at the date of her first admission. "Vision failing for a year past. In the right eye numerous black patches on the retina and some around the entrance of the optic nerve. Some opacity of the lens. Cataract in the left eye." Fully recognising her diathesis, Dr. Bader had prescribed the bichloride of mercury, in doses of one-twentieth of a grain three times a day

On March 10th, 1859, her condition was much as when first described by Dr Bader There was a well-formed homogeneous, bluish cataract in the left eye, which according to her statement, had been present for several years She was quite positive that it had formed within her recollection, and had not existed in infancy The sight of the right eye was so defective that she could not see to read, she (p 272) expressed herself as quite certain that three years ago she could read easily On ophthalmoscopic inspection of the right eye, black striae were seen in the lens and in the vitreous humour. On the retina were many black spots of deposit

This girl's teeth and physiognomy were most typical Her

face was covered with patches of psoriasis, and presented small pits She had had small pox when nine years old

Case XI—Hereditary syphilis—Supervention of a cataract in the eye at three years of age—Iritic adhesions—Full history of syphilis, treated by mercury in the parents

Sarah Ann C, aged 3 - This child was brought for the first time on September 3rd, 1858. In her right eye was a well-formed bluish-white cataract. The pupil was fairly mobile. The other eye appeared perfectly healthy, and there was not the slightest congestion in either Although well-grown and stout, the sunken bridge of her nose and some fissures at the angles of the mouth, at once attracted my attention. was also a patch of psoriasis on one cheek, and all her central upper teeth were affected by that peculiar form of black caries, which I had previously noticed in one or two syphilitic cases. The lower teeth were, with one or two slight exceptions, free from caries Her mother who brought her, was a woman of pale earthy complexion. On enquiry, I ascertained respecting the child, that in infancy she had suffered long and severely from snuffles, had had a very sore mouth, and sores at the anus, which lasted a long time, with also an eruption on the body. Her eyesight had been good in both eyes, until within a few months She had several times had gumboils, and once her tongue had been very sore

The mother told me that her husband was dead, that this was her only child, and that she had miscarried twice since its birth. Her own health, she said, had never been (p 273) good since marriage, and on my asking the direct question, she at once confessed to having venereal disease from her husband prior to her confinement. The medical man who treated her, gave mercury to salivation, and subsequently a copious eruption appeared. The disease was contracted only about two months before her confinement. The infant was not subjected to any special treatment, and beyond the symptoms above mentioned, was not considered ailing. It was at the breast the whole time that her mother took the mercurial course. The mother still suffers from periosteal pains in the head, etc.

Atropine dilated the pupil very imperfectly, and it was then apparent that there were rather extensive adhesions of the inner border of the iris Spots of uvea were seen on the surface of the lens, and in its structure were several masses of yellow chalk

Case XII — Cataract with irritic adhesions in the left eye of a girl known to be the subject of inherited syphilis

Miss H, aged 14, came under notice in consequence of her elder brother being under my care for well-marked interstitial keratitis Her father had lost one eye by syphilitic iritis before his marriage, and his eldest son had suffered severely from infantile symptoms, and presented the various indications of the diathesis, -notched teeth, etc, in a very well-characterized I requested to see his younger sister and she was brought at the next visit She was three years younger than her brother, and the account was that in infancy she was fairly healthy Her teeth showed horizontal notches, but no vertical ones, and there was little or nothing in her physiognomy to have excited suspicion She could see but very little with her left eye On inspection I found the lens in a condition of bluish-white haze It was not densely opaque in any part, but sufficiently so to prevent the transmission of light The pupil was fairly mobile, but there (p 274) were numerous small tags of adhesion between it and the capsule of the lens, the other eye was quite unaffected I did not obtain any clear history of the attack of inflammation during which the changes described had taken place, but her mother said that in early childhood she was quite sure that both eyes had perfect sight She believes that the changes in the left had occurred within the last few years

Case XIII—Extensive inflammatory changes in both choroids—Aspect and teeth of hereditary syphilis

In April, 1860, Dr Bader brought under my notice the following case, which he considered to be an instance of choroidal disease dependent upon hereditary syphilis William N, aged 13, a boy of very dark complexion, and of markedly syphilitic

physiognomy His mother stated that he was her only living child, but she was herself so deaf that it was impossible to obtain any history of his infancy. His eyesight had been failing for many years, but he had never had any attack of external inflammation, his corneae were both perfectly clear, his upper incisor teeth were characteristically notched, his vision was so far impaired that he could only read large print with great difficulty, his left eye was the worse of the two, and both were somewhat improved by the use of concave glasses. On ophthalmoscopic examination the optic entrances in both eyes were seen to be ill-defined, the vessels of the retina were small, and in the choroids were numerous small white patches, interspersed with deposits of pigment, the choroidal patches were not abruptly defined, but merged off gradually into the more healthy structure, the morbid conditions were most advanced in the left eye

Case XIV—Physiognomy of hereditary syphilis characteristically marked—History of a bygone attack of double interstitial keratitis—Choroidal changes in both eyes

The notes of the following case are from those kindly (p 275) supplied to me by Dr Bader In it the choroidal changes were well marked It is from the left eye of this patient that the drawing was taken *

Emily D, aged 18 She was a delicate girl up to the age of ten years, she has suffered much from headaches, at the age of 16 she had an attack of rheumatic fever. It was stated that her sight began to fail twelve years ago, and that seven years ago both eyes were inflamed, but as far as can be ascertained, by the patient's account, without implication of the retina. There was then, it was stated, merely the power of perceiving light, and this continued for some months, after which the inflammation subsided, and the sight gradually improved, the eyes being left in the condition described below. August, 1859, the patient bears the typical marks of hereditary syphilis, the teeth are stumpy, the corneae hazy, the tonsils swollen, and the general aspect clearly indicative of the diathesis. It may be re-

^{*} The plate has not been reproduced E C K

marked that her sister presents similar characteristics The corneae of both eyes are slightly hazy and irregularly oval, the pupils are active but irregular, the irides have the characteristic steel-blue colour, with the right eye she can read the smallest type, and can tell the time on a distant clock, with the left, which was always the weaker and smaller, she can see, but cannot read, large type-she can see the face of the clock but cannot tell the time. It appears, by this examination, that she can see better with some of the lateral portions of the retina. In both eyes, with the ophthalmoscope, the lens and the vitreous humour are transparent When the examination is not assisted by the lens numerous black muscae appear to be floating in the vitreous space (this appearance is due to the oscillation of the eye bringing to view different pigment patches on the fundus). The optic nerves are small and slightly oval, greyish pink, hazy, indistinct, not well defined, and shade off into a whitish ring which separates the rest of the optic nerve entrance from the fundus Passing through the left, a few retinal vessels only are dimly seen, but in the right they are more numerous fundus round the optic nerve and at the yellow spot is hazy, red, and is sprinkled with irregular white and brown patches, and with minute pigment granules On the lateral parts the large choroidal vessels are well seen, and here also the fundus is sprinkled with numerous large well-defined black patches

GENERAL COMMENTS

In addition to the above fourteen cases I might quote several others, in which, in conjunction with keratitis, the choroid was undoubtedly affected. I omit these, however, because the opacicities in the cornea were such as to prevent any satisfactory examination of the state of the deep structures. In the cases which I have adduced we have examples of choroiditis in ten; of deposit in the retina in two (Cases I and X), of inflammatory opacity of the vitreous body in one (Case X), and of opacity of the lens in five (Cases IV, IX, X, XI, XII). The patients varied in age from seventeen months to twenty years, and it would appear probable that the period of life most liable to attacks of

heredito-syphilitic choroiditis, and its cognate affections is the same as that in which interstitial keratitis is most frequent (See page 94). In six instances out of the ten in which the notes advert to this point, the patient was the eldest living in the family. Iritic adhesions were present in four or five of the cases. The patients were all members of different families and represented an aggregate of twenty-one living individuals out of forty births, giving an average to each family of five births and only two living. In these features the group corresponds with what was proved to be the fact as regards the subjects of interstitial keratitis.

Having given the cases in considerable detail, I need not here say anything further in the attempt to substantiate the diagnosis as to hereditary syphilis. As it is often impossible to obtain clear histories, we are not unfrequently in these cases obliged to trust to the physiognomy, and especially to (p 277) the teeth of the patient for data upon which to ground an opinion

In several of the cases adduced, the reader's estimate of the diagnosis will depend to a considerable extent upon his opinion as to the trustworthiness or otherwise of these signs. I rely, however, chiefly on the fact that these instances of choroidal disease in young persons are almost never met with excepting in conjunction with notched upper incisors and syphilitic physiognomy, for support to my opinion as to their true etiology. The cases constitute so marked a group and so closely resemble each other, that if a clear history could be established in but half, there would be fair grounds for suspecting like antecedents in the others also

Concerning Cases IX, X, XI, and XII, which afford examples of the occurrence of cataract in young persons with syphilitic history I may direct attention to the following facts—in none was the cataract congenital, in all there were evidences of inflammatory changes in other tissues of the eye, in three of the cases the cataract was unilateral only, and in the one in which the disease was double the opacity had reached very different stages in the two eyes These facts seem to point to the inference that the opacity of the lens was in all of a more or less

inflammatory character. Its occurrence in one eye only, might be explained by supposing that the changes in the lens had been brought about by acute inflammation of the adjacent structures, and had therefore taken place only in the eye most severely affected. Were the lens liable to become inflamed in syphilitic children, without the intervention of any other morbid condition of the adjacent parts, and simply as the result of blood poisoning, the disease ought to be—as keratitis and choroiditis of this form are—symmetrical. It is much more probable, however, that the lens has very little tendency to take on inflammation, and that it almost never does so excepting secondarily. I have never yet seen an instance of cataracts in the eyes of a supposed subject of inherited taint whose eyes were otherwise sound.

ON THE SO-CALLED AQUO-CAPSULITIS

One of the propositions with which this paper was commenced, was that a majority of the affections hitherto classed as "Aquocapsulitis," were due to hereditary syphilis Although all will admit that it is time that this term—alike barbarous in its terminology and erroneous in the anatomical theory which it suggests-fell into disuse, yet a short space may suitably be here granted to affections which have been so designated It has been applied much too widely by many writers allow it to include all cases in which the posterior layer of the cornea and the surface of the iris were simultaneously inflamed, a large class would be formed, and respecting a majority, indeed almost all, there would be little difficulty in proving a syphilitic history, either hereditary or acquired In many cases of interstitial keratitis when the cornea has regained its transparency sufficiently to allow of inspection of the iris, the latter is seen to have partially lost its lustre, looking thin and of steel-gray aspect, and not unfrequently to have contracted a few slender adhesions Although the severity of the disease has fallen on the cornea it is clear that the iris has also suffered attack, however, the iris has been shut off from view, and the disease consequently designated as keratitis In the cases of acute iritis in syphilitic infants, the cornea, as I have shewn, is but rarely implicated The only cases to which the term "aquocapsulitis" ought never to be applied, are those in which with finely-dotted deposit on the posterior layer of the cornea the structure of that tissue remains transparent and allows of a tumid and inflamed iris being freely inspected Cases in which this conjunction of phenomena exists, do occur, but as far as my observation has gone they are very rare I am speaking, of course, of cases in which the iritic affection and the inflammation of the posterior layer of the cornea are nearly equal in degree In almost all cases of iritis from acquired syphilis, the sprinkled sand-like dottings behind (p 279) the cornea are present, but in these the stress of the morbid process is so evidently upon the iris that we never hesitate as to the designation. Now and then, however, after acquired syphilis the affection which supervenes in the eyes might fairly be called "aquo-capsulitis," the iris being affected but very slightly Limiting the term under consideration as above proposed, I have seen but very few examples of the disease About seven years ago I had under care for some weeks a girl of about 12, of Jewish family, in whom one eye was affected by slight iritis with punctate deposits behind the cornea The corneal tissue never became opaque, and there was never any free effusion of lymph in the iris, the condition proved very intractable, but the opposite eye was never There was no reason for suspecting hereditary syphilis The following three cases comprise all that I have had under care at the Ophthalmic Hospital, and in one of these I did not see the patient during the attack, but only formed my opinion as to its nature by the permanent condition which had been In only one of the three was there the slightest reason to suspect hereditary syphilis, and I am therefore inclined to the opinion that cases of this type are for the most part not de-pendent upon that affection, further evidence is, however, needed on this point

Case I—Dotted deposit on the posterior layer of one cornea, with slight iritis—No suspicion of hereditary taint

Alice G, single, aged 20, of clear complexion, rather pretty, and not presenting any trace of the physiognomy of hereditary syphilis, was admitted on June 9th, 1859 She had a perfectly

regular set of teeth, of good form, and although pallid, considered herself in excellent health. Menstruation had always been regular. She was the sixth of her family, and all her brothers and sisters were reported to be in good health. The affection for which she applied consisted in a group of dotted deposits on the posterior surface of the right cornea. The largest were near the centre, and (p. 280) but few extended higher than the equator of the eye, whilst downwards they occurred almost as low as the margin of the cornea. The pupil acted very sluggishly but was of normal size. Several tags of adhesion between the pupillary margin and the capsule of the lens were visible, but the iris itself was of good colour, and did not look as if it had ever been acutely inflamed.

From the historygiven it appeared probable that these deposits had been present for about two months. Six months ago the eye had been inflamed but the sight did not at that time suffer. The other eye had never been in the least affected.

The remedies prescribed were blisters and mercury, the latter in grain doses of calomel every night. Under these, in the course of three weeks, great improvement resulted, and the deposits were so far absorbed as to allow of her reading the smallest print. Still, however, although much diminished in thickness, the individual dots of deposit were, at the time of the girl's last visit very easily discernible

Case II—Iritis (slight) with punctate deposits in the posterior layers of the cornea in a healthy girl—Suspended menstruation—Improvement under the iodide of potassium

Emily B, aged 16, was admitted on March 3rd, 1859 In both eyes exactly similar conditions existed, the posterior layers of the corneae presenting numerous punctate deposits, and the irides being slightly discoloured, more especially near their free margins. The deposits in the corneae were more numerous in their lower halves than their upper ones, and occupied nearly the same position as those in Case I, being, however, much less extensive. The attack had commenced two weeks before admission. The eyes were irritable, but there was no great in-

tolerance of light She had not menstruated for three months With regard to her diathesis, my notes state "she is tall, well grown, florid, and fairly healthy looking, teeth good in every respect"

(p 281) The treatment adopted consisted of the exhibition of the iodide of potassium in five-grain doses three times a-day. Under this she improved very decidedly Menstruation occurred about a fortnight after her admission, and on March 24th the notes state that the corneal opacities had almost disappeared

Case III.—Dotted deposits (permanent and earthy) on posterior layers of both cornea—Evidences of past 111tis—Hereditary syphilis probable

Edwin R, aged 14, came under my care in June, 1859 On the posterior layer of both cornea were numerous isolated dots of white deposit, which looked as if they consisted, in part at least, of chalk (Mr Dixon quite agreed with me in this opinion) These had resulted from an inflammation which had occurred four years ago There were also some slender tags of adhesion between the pupillary margin and the capsule of the lens. He had fair vision, and what of imperfection existed, was fully accounted for by the state of the cornea. The condition of the latter was so peculiar and illustrated so well the disease under consideration that I had a sketch taken. The boy was very decidedly of syphilitic physiognomy as was also his elder brother who came with him. Unfortunately I had no opportunity of obtaining any history of his infancy. As the changes were undoubtedly permanent no treatment was adopted

Tinea Tarsi—Falling of the Lashes and Muco-Purulent Ophthalmia, as Connected with Hereditary Syphilis

The wish to notice in this paper all the affections of the eye and its appendages, which I have hitherto observed inconnexion with inherited syphilis, induces me to group together the abovenamed. They are all alike in this, that they are by no means peculiar to the subjects of hereditary (p. 282) taint. Of iritis, choriditis, kerato-iritis, and interstitial keratitis, as met with

in infants and young persons, I venture the assertion that in a vast majority of instances, they are directly due to that cause. With tinea tarsi, etc., however, it is wholly different, they are very simple affections, and very rarely syphilitic. To take first—

Tinea tarsi — When this disease is of syphilitic origin, whether inherited or acquired, it may usually be distinguished by the circumstance that small abruptly-margined patches of exconation extend away from the lashes into the cutaneous surface of the lids. These patches are irregular in shape, and are most commonly observed near the angles. They give to the lids an appearance of great irritation and soreness. Again, syphilitic tinea tarsi is apt to be very obstinate in treatment, unless constitutional specifics are employed. It is interesting to remark, that when tinea tarsi, in a severe form is not syphilitic, it is still usually a secondary phenomenon to some specific disease. Measles is undoubtedly a most frequent cause; scarlet fever and small-pox are so more rarely; it is by no means rare, and often complicates the form of keratitis about to be described. The following may be cited as a good example.—

Case of obstinate tinea tarsi following a syphilitic rash in a young infant

A pallid but fairly stout boy, aged 2, was brought to me at the Metropolitan Free Hospital in June 1858, on account of what looked like catarrhal ophthalmia with severe tinea tarsi. The tinea had existed for eighteen months, the mucous discharge and conjunctival congestion for only a fortnight. Had the disease followed the measles, I asked "No," was the reply, "but he had a bad rash out on his body before the eyes came sore." There was that in the way the mother spoke of the rash which made me think that she wished the term to convey something of particular and (p. 283) mysterious importance, and having observed also that the boy's nose was sunken, and that the little excoriated patches on the edges of the lids were present, I at once asked as to syphilis. A full history of the disease both in the mother and infant was at once freely given, and the requisite remedies were accordingly prescribed.

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Falling of the lashes.—I need say no more of this symptom than that it occasionally happens in syphilitic infants. It has, no doubt, the same relation to the original disease as the alopecia which is not unfrequently observed in adults as a secondary symptom.

Muco-purulent Ophthalmsa — The why purulent reason ophthalmia is so common in syphilitic infants is, no doubt, to be found in the fact that the mothers of such usually suffer from syphilitic leucorrhea. The contagion is usually conveyed to the infant's eyes during birth, and the disease is to be regarded as a local one I have, however, seen so many instances of mucopurulent ophthalmia beginning in infants at intervals of a month or two after birth, and in association with other symptoms of inherited syphilis that I cannot but think that this form is often of constitutional origin The conjunctivitis is probably of the same character as the inflammation of the Schneiderian membrane of the nose, to which the snuffles, nasal discharge, It is rarely so acute as the true purulent ophthalmia etc , 1s due

THE END



MEDICAL CLASSICS

Compiled by

EMERSON CROSBY KELLY, M D, FACS. of the department of surgery, albany medical college

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SIR WILLIAM BOWMAN

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Sir William Bowman

BIOGRAPHY

- 1816 Born July 20, at Nantwich, England His father was John Eddowes Bowman, a banker by profession and a botanist and geologist by avocation, his mother was a skilled draughtswoman and painter of flowers
- 1826 Age 10 Attended school with his two brothers at Hazelwood School, near Birmingham Became editor of the school paper and took several prizes
- 1832 Age 16 Apprenticed to Mr Joseph Hodgson, a highly philosophical surgeon and a member of the Society of Friends His desire to enter the medical profession seems to have arisen from the interest he took in the treatment of a wound of his hand received when experimenting in the laboratory with gunpowder.
- 1835 Age 19 Though still a student, wrote papers on influenza, hemorrhage and paraplegia which, however, were not published until the year of the author's death Executed several fine colored anatomic drawings, some of which were published in Ryland's Diseases of the larynx
- 1837 Age 21 Went to London as an advanced student from Birmingham to the medical department of King's College
- 1838 Age 22 Succeeded John Simon in the physiological prosectorship under Todd Visited the hospitals of Holland, Germany, Vienna and Paris
- 1839 Age 23 Became Junior Demonstrator of Anatomy at King's College (Simon was Senior) and Curator of the Museum Wrote important paper on The structure of striated muscle.

- 1840 Age 24 Passed his examination at the Royal College of Surgeons Became associated with Partridge, Professor of Anatomy and Second Surgeon at King's College Hospital while Simon was associated with Fergusson, Professor of Surgery at the same institution
- 1841 Age 25 Elected a Fellow of the Royal Society at an unusually early age, the result of his histologic work on muscle
- 1842 Age 26 Wrote remarkable treatise on *The structure of the kidney*, which brought him the Royal Medal of the Royal Society Married Miss Harriet Paget and had seven children
- 1843 Age 27. Published the first part of *Physiological anatomy* and physiology of man, written with Todd The fourth and last part appeared in 1856 and the entire work constitutes a monumental treatise on physiology
- 1844 Age 28 Elected Fellow of the Royal College of Surgeons
- 1846 Age 30. Appointed Assistant Surgeon to the Royal London Ophthalmic Hospital at Moorfields
- 1847 Age 31 Began his valuable contributions to ophthalmology by an address at the Oxford meeting of the British Association on the structure and function of the ciliary muscle
- 1851 Age 35 Became full Surgeon to the Royal London Ophthalmic Hospital Established a close friendship with von Graefe, the German, and with Donders, the Dutch ophthalmologists (This was the year Helmholtz invented the ophthalmoscope)
- 1857 Age 41 Published a translation of von Graefe's work on iridectomy for acute glaucoma and became a strong advocate of the operation
- 1864 Age 48 Described the needle operation for detached retina
- 1867 Age 51. The degree of M D was conferred on him by the University of Dublin
- 1876 Age 60 Retired by reason of his age from the Royal London Ophthalmic Hospital but for a number of years longer he remained preeminent in private practice

- 1880 Age 64 Became the first President at the founding of the Ophthalmological Society of the United Kingdom Received the degree of LLD from Cambridge University
- 1881 Age 65 Served as Chairman of the Ophthalmological Section of the Seventh International Medical Congress
- 1884 Age 68 Created a baronet
- 1888 Age 72 On his retirement from practice, his writings were reprinted in two testimonial volumes (although they did not leave the press until 1892
- 1892 Age 76 Died on March 29, of pneumonia, at his country house, Joldwynds, near Dorking, Surrey, England Was still an active member of the Council and Chairman of the Medical Committee of King's College Buried in the churchyard at Holmbury St Mary

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INTRODUCTION

William Bowman gave promise at an early age that he would become a leader in the medical profession and that his name would be remembered, both in anatomic and ophthalmologic fields. He is an excellent example of mature greatness giving hint of itself at an early age. While still in medical school he wrote several papers which were delivered before the student societies but were not published, the author thought them unworthy of print. Many years later, when these writings were published in his Collected papers, he expressed surprise that he had known so much in his early days. Then, too, he had executed several excellent anatomic drawings which were included in Ryland's Diseases and injuries of the larynx and trachea. Truly William Bowman was off to an early start.

After finishing his medical course in London, Bowman made the customary tour of the hospitals of the Continent He then returned to London, joined the anatomic department of King's College, and a year later became associated with Dr Partridge, Second Surgeon at King's College Hospital This first phase of Dr Bowman's professional career is marked by several publications which alone would entitle him to fame First is a paper on Mucous membrane, muscle, muscular motion, pacinian bodies published in 1839 in the third volume of Todd's Cyclopedia of anatomy and physiology The next year appeared a paper On the minute structure and movements of voluntary muscle, followed shortly by Additional note on the contraction of voluntary muscle in the living body In 1842 Bowman published On the structure and use of the Malpighian bodies of the kidney, with observations on the circulation through that gland This landmark in our knowledge of the anatomy and physiology of the kidney is accompanied by a fine plate The work is here reproduced in its entirety

Four years after Bowman published his work on the kidney he was appointed Assistant Surgeon to the Royal London Ophthalmic Hospital and a year later began his contributions to ophthalmology. In this field Bowman did his best work and his name must be linked with that of von Graefe and Donders, the great ophthalmologists of Germany and Holland, who were his close friends. Bowman's contributions to this special field cover many subjects from the anatomy of the eye to surgical procedures.

One of his earliest papers on ophthalmology is Lectures on the parts concerned in the operations on the eye, and on the structure of the retina, delivered in 1847. The first two lectures, with seven plates, are herein reproduced from a book of the same title, printed in London in 1849.

John Whitaker Hulke, in delivering the Bowman Lecture in 1890, says that the book "yet repays attentive reading I would especially mention the chapter on the retina, that on the ciliary muscle, and that on the cornea In the first of these the sequence of the several retinal layers, the forms of their elementary tissues, and to some extent their structural interrelations are demonstrated with a clearness that carried the histology of the retina very greatly in advance of the work of the earlier investigators, and which evidenced the highest talent for minute investigation and interpretation of structure Not less excellent is the chapter on the cornea, in which are shown with a perspicuity and thoroughness that left little to be added, the structure of the cornea, the beautiful arrangement of the tissues bounding its outer surface, and also the interstitial spaces within it The 'anterior elastic lamina' of the cornea, and the interstices in the corneal tissue there made known, as was lately mentioned by our present President in his Inaugural Address, soon received the familiar names by which we still call them—'Bowman's membrane,' 'Bowman's tubes'"

For other contributions of Bowman, please consult the bibliography The ophthalmologist will find references to the original descriptions of many of the operations which he performs today Any of these descriptions could be reprinted with interest and value But for this number of Medical Classics it has been thought best to republish the basic work of Bowman, both on the minute structure of the kidney and on the eye



On the Structure and Use of the Malpighian Bodies of the Kidney, with Observations on the Circulation through that Gland

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HESE remarkable bodies have been an object of much interest since their discovery by the great anatomist whose name they bear. Malpighi found they could be injected with great facility from the arteries, and he imagined them to be glands, in which the urine is elaborated

from the blood. He seems also to have been of opinion that in them the uriniferous tubes take their rise ¹. Ruysch examined them with great care, and preserved specimens in his museum in which he believed that he had shown, by injection, that in them the arteries are continuous with the tubes ². This was the

² "Quarum (gland Malpigh) nonnullae hic dissolutae, in ductus Bellinos degenerant"

—Ruyschius, Thesaurus Anat x No 86 "Corpuscula rotunda et glandiformia in

¹ See his chapter "de internis glandulis renalibus, earumque continuatione cum vasis," a work not less conspicuous for the sterling accuracy of its observations than for the sagacity displayed in the reasonings based on them

principal ground for the famous, but now exploded theory, of the existence of exhalant arteries with open mouths, which in the secreting glands opened directly into the excretory canals. It is probable that this accurate observer mistook the efferent vessel of the Malpighian body for a uriniferous tube, for the efferent vessels of those Malpighian bodies that he near the medullary part of the kidney, take the same course as the tubes, and are often large enough to be readily mistaken for them. The statement, however, of Ruysch and others, that the tubes may be injected from the arteries, is true, though in a different sense from that in which they understood it

Schumlansky,⁴ some years afterwards, entertained more complete views of the connection between these bodies and the uriniferous tubes, and he has even given an ideal diagram of this connection, which shows that he had a very clear conception of the fact. From a considerable error, however, in the proportion of these bodies to the tubes (represented in his figure), it has been suggested that his description could not have been drawn from nature, a censure that seems to have been little merited

(p 58) Huschke⁵ and Muller⁶ are the only modern anatomists who have entered at length into this question, and they both deny that there is any connection between the Malpighian bodies and the uriniferous ducts. The assertions of Muller, in particular, are so positive, and are reiterated in so pointed a manner, that nothing but the most clear demonstration of their erroneous nature would have induced me to uphold an opposite opinion.⁷

totum sunt dissoluta et extricata Ductus qui dicuntur Bellini, in totum quoque repleti sunt propter repletionem arteriolarum "-Ibid No 149

³ Barnardus Albinus, after injecting the Malpighian bodies from the arteries, "vasa urinae exinde prodeuntia eodem colore farta beatus conspexit"—Albinus, p 63, 64 Vide Schumlanskii Dissert Inaug Anatomicam de renum structura Argentorati, 1782, p 69

⁴ Schumlansky, op cit

⁵ Huschke, Ueber die Textur der Nieren Isis, 1828, p 561

⁶ Joh Müller, de Glandularum secernentium structura penitiori Lipsiae, 1830, lib

⁷ Huschke says (quoted by Müller), "These corpuscles (Malpighian bodies) are without any connection with the uriniferous ducts. For these most distinctly terminated by free blind extremities, while the Malpighian bodies, everywhere scattered in the interstices

I was led to the examination of these bodies in the course of an inquiry into the ultimate structure of the true glands, in which I have been engaged for the last two years I had frequently injected them from the artery, but had never inspected them under high powers of the microscope, until they arrested my attention while examining the structure of the uriniferous tubes These tubes consist of an external tunic of transparent homogeneous tissue (which I have termed the basement membrane), lined by epithelium The Malpighian bodies I saw to be a rounded mass of minute vessels invested by a cyst or capsule8 of precisely similar appearance to the basement membrane of the tubes Seeing these similar tissues in such close proximity, it was not easy to resist the conviction that the capsule was the basement membrane of the tubes expanded over the vessels, but, after many trials, I could not at that time succeed in gaining an unequivocal view of their continuity All that I could accomplish was to perceive here and there an ambiguous approach to such an arrangement, sufficient to make it appear probable

I should perhaps have relinquished the idea thus presented to my mind, had not accident again drawn me to it. Having, during last summer, been made acquainted, through the kindness of Dr Milne Edwards, with a new method of injection employed with great success by M Doyère of Paris, I injected some

of the tortuous uriniferous ducts, are only connected with the blood-vessels "-Muller, loc cit, p 87

Müller says, "Attamen certissimum est, ex vasis sanguiferis, ductus uriniferos plane nunquim usquam repleri, massamque injectam ne quidem laceratione in tubulos uriniferous prorumpere," op cit, p 98 "Fines ductuum uriniferorum in corpora Malpighiana desinere, certissime filsa issertio est," p 95 "Falsissima est opinio de connexu ullo quopiim inter corpora Malpighiana sanguifera, et ductuum uriniferorum fines," p 95 And other passages equally strong might be quoted

⁸ First particularly pointed out by Muller, who conceives it to be perfectly closed, except at one point where perforated by the vessels

This consists of two fluids which mingle in the small vessels, and cause a precipitation there. The best fluids are saturated solutions of bichromate of potass and of acetate of lend. They are injected in succession through the same vessel, whence the method is termed that by double injection. Krause published an account of it two years ago, but M. Dovère appears to have arrived at it after a laborious trial of numerous solutions. Both deserve the thanks of anatomists for so valuable an addition to the means of investigation.

kidneys through the artery, by this method, in order to notice the nature of the vascular ramifications in the Malpighian bodies. I not only found what I sought, but the clearest (p 59) evidence that the capsule which invests them is, in truth, the basement membrane of the uriniferous tube expanded over the tuft of vessels The injected material had, in many instances, burst through the tuft, and, being extravasated into the capsule, had passed off along the tube I have since made numerous injections of the human kidney, and of that of many of the lower animals, and in all, without exception, have met with the same I have also repeated, with better success than before, the examination of thin slices of the recent organ with high powers of the microscope, and in this manner have fully corroborated the evidence furnished by injections This mode of examination has likewise led to the interesting discovery of ciliary motion within the orifice of the tube

According to my own observations, the circulation through the kidney may be stated to be as follows.—All the blood of the renal artery (with the exception of a small quantity distributed to the capsule, surrounding fat, and the coats of the larger vessels) enters the capillary tufts of the Malpighian bodies, thence it passes into the capillary plexus surrounding the uriniferous tubes, and it finally leaves the organ through the branches of the renal vein Following it in this course, I shall now endeavour to describe the vascular apparatus, and the nature of its connection with the tubes

With the inconsiderable exceptions just mentioned, the terminal twigs of the artery correspond in number with the Malpighian bodies. Arrived here, the twig perforates the capsule, and, dilating, suddenly breaks up into two, three, four, or even eight branches, which diverge in all directions like petals from the stalk of a flower, and usually run, in a more or less tortuous manner, subdividing again once or twice as they advance,

¹⁰ As the mode of subdivision of this artery in the interior of the organ is well known, I have omitted to describe it. Its branches never anastomose. It almost invariably happens that the twigs ending in the Malpighian bodies are of considerable length, but occasionally (as in fig. 8) two bodies are sessile on very short twigs of a single branch.

over the surface of the ball they are about to form. The vessels resulting from these subdivisions are capillary in size, and consist of a simple, homogeneous, and transparent membrane. They dip into its interior at different points, and after further twisting, reunite into a single small vessel, which varies in its size, being generally smaller, but in some situations larger than the terminal twig of the artery. This vessel emerges between two of the primary divisions of the terminal twig of the artery, perforating the capsule close to that vessel, and, like it, adhering to this membrane as it passes through. It then enters the capillary plexus which surrounds the tortuous uriniferous tubes in

The tuft of vessels, thus formed, is a compact ball, the several parts of which are held together solely by their mutual interlacement, for there is no other tissue (p 60) admitted into the capsule besides blood-vessels. It is subdivided into as many lobes as there are primary branches of the terminal twig or afferent vessel, and these lobes do not communicate, except at the root of the tuft There are, therefore, deep clefts between them, which open when the lobes are not greatly distended with injection or blood. The surface of the tuft is everywhere unattached and free, and continuous with the opposed surfaces of the lobes The whole circumference of every vessel composing the tuft, is also free, and lies loose in the cavity of the capsule These circumstances cannot be seen in specimens gorged with injection, but only by careful examination of recent specimens with a power of 200 or 300 diameters. The vessels are so perfectly bare, that in no other situation in the body do the capillaries admit of being so satisfactorily studied. It is only where the tuft is large, as in Man and in the Horse, that its lobulated character can be always discerned When the number of primary subdivisions of the afferent vessel is smaller, the detection of lobes is less easy. They may often be seen, however, in the Frog

[&]quot;Caeterum glomeruli ulterior conformatio in praestantissimus quamvis injectionibus non facile extricari potest. Videor tamen observasse arteriolam, quae glomerulo accedit, cirri adinstar dividi, unde tortuosa vascula oriuntur, quae ansis secum arcte connectuntur et recurrunt. Sed hoc certum est, glomerulos libere in vesiculis contineri, nec ullibi, nisi uno in puncto, cum vesiculis cohaerere."—Müller, loc cit, p. 101

In Birds and Reptiles, the afferent vessel seldom divides, but dilates, instead, into a pouch-like cavity, which, after taking two or three coils, contracts again and becomes the efferent vessel Here of course there are no lobes, but the surface of the whole dilated part is free

The basement membrane of the uriniferous tube, expanded over the Malpighian tuft to form its capsule, is a simple, homogeneous, and perfectly transparent membrane, in which no structure can be discovered. It is perforated, as before stated, by the afferent and efferent vessels, and is certainly not reflected over them They are united to it at their point of transit, but in what precise manner I have not been able to determine Opposite to this point is the orifice of the tube, the cavity of which is continuous with that of the capsule, generally by a constricted neck I have specimens prepared with the double injection showing this continuity in Mammalia, Birds, Reptiles and Fish, and, in Mammalia and Reptiles, I have obtained the still more satisfactory proof afforded by a clear view of the whole of the textures magnified 300 diameters As the Malpighian bodies are placed in every possible direction, it often happens that a thin section, parallel to the neck of the tube, cannot at once be obtained but with perseverance this may always be done The capsule is then seen to pass off into the basement membrane of the tube, as the body of a Florence flask into its neck The basement membrane of the tube is lined by a nucleated epithelium of a finely-granular opake aspect, while the neck of the tube and its orifice become abruptly covered with a layer of cells much more transparent, and clothed with vibratile cilia epithelium is continued in many cases over the whole inner surface of the capsule, in other instances I have found it impossible to detect the slightest appearance of it over more than a third of the capsule When fairly within the capsule, the cilia cease, and the epithelium beyond is of excessive delicacy and translucence Its particles are seldom nucleated, and appear liable to swell by the addition of the water added to the specimen They frequently fill up the space between the capsule and tuft, and touching the latter, may seem to be united to it (p 61)

The lines of their mutual contact may then wear the aspect of a highly delicate areolar tissue, connecting the capsule with the tuft. The cavity existing in the natural state between this epithelium and the tuft, is filled by fluid, in which the vessels are bathed, and which is continually being impelled along the tube by the lashing movement of the cilia. In the Frog, where alone I have as yet been able to see these wonderful organs in motion, they were longer than those from other parts of that animal, and extremely active

The tubes, on issuing from the Malpighian bodies, invariably become greatly contorted I have on one occasion seen two of them unite, and from their dichotomous mode of division, when traced up from the pelvis, there can be little doubt that this is constantly their disposition I have never, in all my examinations, met with any appearance of an inosculation between different tubules The tortuous tubes unite again and again in twos, and finally, under the name of pyramids of Ferrein, become straight, and converge towards the pelvis, forming the medullary cones or pyramids of Malpighi The Malpighian bodies are imbedded in a kind of nidus formed among these convolutions, and are touched on all sides by the surrounding tubes emergence of the tube from the Malpighian body can be seen only at one point, it is not wonderful that it should have been overlooked, and that the demonstration should have seemed clear, that the Malpighian bodies merely lie among the tubes, and have no connection with them

The blood, leaving the Malpighian tufts, is conveyed by their efferent vessels to the great renal reservoir, the capillary plexus surrounding the uriniferous tubes. This, in its general arrangement, resembles that investing the tubes of the testis. The vessels lie in the interstices of the tubes, and everywhere anastomose freely, so that throughout the whole organ they constitute one continuous network, lying on the outside of the tubes, in contact with the basement membrane. This plexus is interposed between the efferent vessels of the Malpighian bodies and the veins

The efferent vessels of the Malpighian bodies are always soli-

tary and never mosculate with one another each one is an isolated channel between its Malpighian tuft, and the plexus surrounding the tubes. They are formed by the union of the capillary vessels of the tuft, and emerge from its interior in the manner already explained After a course of variable length they open into the plexus Their size is various In general, they are smaller than the terminal twig of the artery, and scarcely, if at all, larger than the vessels of the plexus into which they discharge But where the Malpighian tuft is large, the efferent vessel is usually large also, and divides into branches before entering the plexus. This is eminently the case with those situated near the base of the medullary cones, where the medullary and cortical portions of the organ seem to blend efferent vessels from these large Malpighian bodies are often three or four times the diameter of those of the plexus, and take a course towards the pelvis of the kidney between the uriniferous They were formerly mistaken for tubes They branch again and again in the manner of arteries, (p 62) and form the plexus with long meshes which invests this part of the tubes Some of the veins springing from this plexus form the well-known network on the nipple-shaped extremities of the cones, around the orifices of the tubes, and thence take, with the remainder, a backward course, likewise parallel to the tubes, to empty themselves into venous branches that he about the bases of the cones. These also, when injected, have been mistaken for tubes

The other venous radicles are dispersed at about equal distances throughout the cortex of the kidney, and each receives the blood on all sides from the plexus surrounding the convoluted tubes. When these venous radicles are congested, or injected, they mark out the surface of the cortical substance into lobules not very unlike those of the lobules of the liver. On the Horse's kidney, especially, this may be often well seen. Each lobule contains many tortuous ducts with their capillaries, but the convolutions of any one duct are not confined to a single lobule. These radicles unite in an irregularly arborescent figure, anastomose and form the several branches of the renal vein. Those on the surface, especially of the human kidney, have a tendency to converge

towards a central vessel which then dips into the interior, and runs, like the rest, towards the hilus. Thus are formed the stellated vessels of anatomists, often conspicuous in diseased specimens. Between the sprauling arms of these stellae the convoluted tubes, with their plexus, come up to the surface (Plate IV, fig. 11), but the Malpighian bodies are rarely, if ever, visible quite on the surface. They are always covered in by convolutions of the tubes

The veins from the capsule and surrounding fat join the renal vein in some part of its course. It is probable that the capillaries of the vasa vasorum, within the substance of the organ, pour their blood into the capillary plexus surrounding the tubes, as those of the hepatic artery do into the portal-hepatic plexus of the lobules of the liver

Thus there are in the kidney two perfectly distinct systems of capillary vessels, through both of which the blood passes in its course from the arteries into the veins the 1st, that inserted into the dilated extremities of the uriniferous tubes, and in immediate connection with the arteries, the 2nd, that enveloping the convolutions of the tubes, and communicating directly with the veins. The efferent vessels of the Malpighian bodies, that carry the blood between these two systems, may collectively be termed the portal system of the kidney. To these distinct capillary systems, I am inclined to attribute distinct parts of the function of the organ, and their importance seems to warrant a few words, in further explanation of their anatomical differences

The former, which may be styled the Malpighian capillary system, is made up of as many parts as there are Malpighian bodies. These parts are entirely isolated from one another, and, as there is no inosculation between the arterial branches supplying them, the blood enters each in a direct stream from the main trunk. This capillary system is also highly remarkable, indeed stands alone among similar structures, in being bare. The secreting tubes of the kidney, like those of all other glands, are, (p. 63) strictly speaking, an involution of the outer teguments of the frame, their interior is, in one sense, the outside of the body their walls intervene between the vessels and the exterior, and,

as it were, cover them in But here is a tuft of capillaries extruded through the wall of the tube, and lodged in a dilatation of its cavity, uncovered by any structure Bare indeed, yet screened from injury in its remote cell, with infinite care and skill! Each separate part, also, of this system, has but one afferent and one efferent channel, and both of these are exceedingly small, compared with the united capacity of the capillary tuft. The artery in dividing, dilates, then follow branches which often exceed it in size, and which gradually break up into the finest. The efferent vessel does not usually even equal the afferent, and in size is often itself a capillary. Hence must arise a greater retardation of the blood in the tuft, than occurs probably in any other part of the vascular system, a delay that must be increased by the tortuosity of the channels to be traversed

The other system of capillaries, or that surrounding the uriniferous tubes, corresponds, in every important respect, with that investing the secreting canals of other glands. It is well known to anatomists, and therefore does not require to be described at any length. Its vessels anastomose with the utmost freedom on every side, and lie on the deep surface of the membrane that furnishes the secretion

I have applied the term 'portal system of the kidney' to the series of vessels connecting these two, on account of the close analogy it seems to bear to the vena porta. The precise quality of the blood it carries may be doubtful, but in distribution it is similar It intervenes between two capillary networks, the first of which answers to that in which the vena porta originates, and the second to that in which the vena porta terminates The obvious difference lies in its several parts not uniting into a single trunk, to subdivide afterwards, but this circumstance seems to admit of an easy explanation A trunk is formed in the great portal circulation, for the convenience of transport, most of the capillaries which supply it lying at a distance from the liver Some, however, viz those drawn from the hepatic artery, either enter the portal-hepatic plexus directly, (as Muller thinks, and as my preparations certainly show some of them to do,) or else join the minuter twigs of the portal vein, according to the opinion of Kiernan Now, in the kidney, the vessels issuing from the Malpighian tufts are disseminated pretty equally throughout the plexus surrounding the tubes (the one into which they have to discharge themselves), and they therefore enter it at all points at once, without uniting. In the medullary cones, however, where there is a capillary plexus to be supplied with blood, but no Malpighian bodies nearer than the base of the cones, the conditions which oblige the formation of a portal venous trunk begin to operate, the two capillary systems it serves to connect are at some distance apart. Here, consequently, the Malpighian bodies are generally larger, their efferent vessels more capacious, and branched after the manner of an artery. Each one of these efferent vessels is truly a portal vein in miniature.

(p 64) The capillary plexus surrounding the tubes differs, therefore, from that of other glands, and agrees with that of the liver, in its receiving blood that has previously traversed another system of capillary vessels. That other system is a peculiar one, as already pointed out, and cannot be likened closely to that which furnishes the portal vein of the liver.

The preceding account of the existence of a true portal system in the kidney of the higher tribes of Vertebrata was already written, when an opportunity presented itself of inspecting the distribution of the vessels in one of those lower animals, in which, besides the renal artery, the kidney is furnished with a portal vein, derived from the hinder part of the body. The presence of such a vein, though denied by Meckel, was well established by Nicolai, whose statements have been confirmed by others, but I am not aware that any anatomist has explained its remarkable distribution, and its connection with the other vessels ¹² I shall therefore introduce a summary account of my examination of the kidney of the Boa Constrictor (the animal in question), which may be regarded as a model of this variety, and I think it will be found not only to show the correctness of the analogy I have

¹² Huschke, who seems to have entered into the greatest detail on this subject, states that he was unable to ascertain in the Serpent's kidney, whether the twigs of the artery were distributed to the Malpighian bodies or not In the Frog, however, he describes the Malpighian bodies as appended to the terminal twigs of the artery Isis, 1828, p 566-7

drawn between the efferent vessels of the Malpighian bodies and a portal system, but to place in a clearer light the other striking resemblances between the circulation of the liver and kidney.

The kidney of the Boa, being composed of isolated lobes, of a compressed reniform shape, displays all the points of its structure in peculiar simplicity and beauty. At what may be termed the hilus of each lobe, the branches of the vena porta and duct separate from those of the renal artery and emulgent vein, the two former spreading side by side, in a fan-like form, over the opposite surfaces of the lobe, while the two latter enter its substance, and radiate together in a plane midway between these surfaces. The lobe is made up of the ramifications of these four sets of vessels, in the following mode Each duct, as it runs over the surface, sends down a series of branches which penetrate in a pretty direct manner towards the central plane. Arrived there, they curl back, and take a more or less retrograde course towards the surface, and finally, becoming more convoluted, terminate in the Malpighian bodies, which are all situated in a layer at some distance within the lobe, parallel to the central plane, and nearer to it than to the surface. The ducts never anastomose artery subdivides into extremely minute twigs, no larger than capillaries, which diverge on size as the afferent, and on emerging, take a direct course to the surface of the lobe, and join the branches of the vena porta there spread out The branches of the portal vern on the surface, send inwards a very numerous series of twigs of nearly uniform capacity, and only a little larger than the vessels of the capillary plexus, in which (p 65) they almost immediately terminate This is the plexus surrounding the uriniferous tubes. It extends from the surface to the central plane of the lobe, and there ends in the branches of the emulgent vein

Thus the efferent vessels of the Malpighian bodies are radicles of the portal vein, and, through the portal vein, empty themselves, as in the higher tribes, into the plexus surrounding the uriniferous tubes. The only real difference between this form of kidney and that of Mammalia, is, that there is here a vessel bringing blood that has already passed through the capillaries

of distant parts, to be added to that coming from the Malpighian bodies, and to circulate, with it, through the plexus surrounding the tubes. The efferent vessels of the Malpighian bodies run up to the surface in order to throw their blood through the whole extent of the capillary plexus, which they would fail to do, if they entered it in any other part

I have described the renal artery as being spent upon the Malpighian bodies, but in the hilus of the lobe it gives off, as in the higher animals, a few slender twigs to the coats of the excretory ducts and of the larger vessels. The capillaries of these twigs are easily seen, and, in all probability, discharge themselves into the branches of the portal vein

The circulation through this form of kidney, may be aptly compared with that of the liver, as described by Mr. Kiernan in his invaluable paper on that gland. The plexus surrounding the tubes corresponds with the portal-hepatic plexus, which, in the lobules of the liver, invests the terminal portions of the bileducts. Both these plexuses are supplied with blood by a portal vein, derived chiefly from the capillaries of distant organs, but in part from those of the artery of the respective organs themselves. The only difference seems to be, that, while, in the liver, the branches of the artery are entirely given to the larger bloodvessels, ducts, &c, in the kidney, a few only are so distributed, the greater number going through the Malpighian bodies, to perform an important and peculiar function. In both glands, however, all the blood of the artery eventually joins that of the portal vein. The emulgent vein of the kidney answers to the hepatic vein of the liver.

The comparison between the hepatic and renal portal circulation may be thus drawn in more general terms. The portal system of the liver has a double source, one extraneous, the other in the organ itself so, the portal system of the kidney, in the lower tribes, has a two-fold origin, one extraneous, the other in the organ itself. In both cases the extraneous source is the principal one, and the artery furnishing the internal source is very small. But in the kidney of the higher tribes, the portal system has only an internal source, and the artery supplying it is proportionally large.

The above account appears to me to comprise whatever is most important in the anatomy of the blood-vessels and ducts of the kidney. My object in it has been to convey an idea of the physiological anatomy of the gland, and I have therefore omitted to mention (except where it suited my purpose) those rougher characters of the kidney in the various classes, that result from varieties in the mode of aggregation of (p. 66) its several constituent parts. The principal of these are well known, and it would have diverted attention too much to delineate others, especially as such peculiarities are of trifling moment. The accompanying illustrations I have endeavoured to execute with scrupulous fidelity after nature. The injected specimens from which several of them are taken, are, with numerous others, in my possession, and those that can be examined only in a recent state, may usually be prepared with facility.

I shall now state the results of my injections of the kidney of Man and the higher animals by the arteries, veins, and ducts, in order to show their accordance with the view I have given of the nature of the Malpighian bodies, and of the vascular apparatus of the organ. This may be also desirable for purposes of comparison with the statements of other anatomists (which, to avoid prolixity, I have not referred to in detail), and it will, besides, give a full opportunity of testing the correctness of my statements, to those inquirers who may be disposed to do so ¹³

By the Arteries, the Malpighian Tufts can be injected with great facility, and also, with less freedom, the Capillaries surnounding the uriniferous tubes. The Tubes also may be injected, by extravasation from the Malpighian tufts.

The course of the injection to the tufts is direct and free The arterial tree is of small capacity, and there is seldom so much blood in it after death as to impede the flow of the artificial fluid. My

13 It is worthy of notice, as showing both the difficulty of the subject and the uncertain state of our knowledge up to the present time, that Berres, the distinguished Professor of Vienna, in his recently published work on microscopical anatomy, maintains the existence of a direct inosculation of the uriniferous tubes with the capillary plexus surrounding them After the description already given, I need hardly say, that this view seems to me, for many reasons, altogether untenable

preparations show this tree injected in various degrees, by the double fluid (Plate IV, figs 1 to 14) In some, the tufts are full, the afferent and the efferent vessels are both seen, as well as the communication of the latter with the plexus surrounding the tubes (figs 2, 4, 5, 6) In others, the vessels of the tuft have given way under the pressure of the fluid, which has then escaped into the capsule and often into the tube also¹⁴ (figs 4, 9, 10, &c) Sometimes the injection has passed freely and without extravasation through only a portion of the Malpighian tuft, leaving the rest filled with blood, which could not have happened to an unbranched coil of vessel, as this tuft is by some described 15 In these, the afferent and the efferent vessels are both injected, but only a fragment of the tuft (fig 2) Sometimes the injected fluid has burst out immediately on entering the first branches (67) of the tuft, it has then insinuated itself between the ball of vessels and the capsule, and has run off along the tube this case the tuft is left uninjected and containing blood, and it becomes enveloped in a film of injection (fig 9) Sometimes one side only of the tuft is injected at the moment when extravasation occurs, sometimes the whole, and likewise the efferent vessel (figs 3, 4) In general, the capsule, when thus filled with extravasated injection, has a perfectly smooth external surface, but when the tuft within is also much distended, this may, in the dried and somewhat collapsed specimen, give to the outer surface of the capsule an uneven appearance like that of the tuft itself The capsule, when distended, is seen in many instances to bulge and form a prominent circle round the point at which the vessels enter and emerge The vessels then appear to lie in a small pit or fissure before becoming connected with the tuft (fig 9) Lastly, it occasionally happens that though extravasation has

¹⁴ I have great pleasure in stating that my friend Mr Tomes, three years ago, during his examination of numerous kidneys that he had injected, saw two or three examples of this escape of the injection along the tube, of one of which he has preserved a rough outline. Not being able to see it again he gave up the search. I have no doubt that he communicated this fact to me in conversation at the time, though I cannot now recollect his doing so. The first drawing I made of the tube expanded over the tuft, I find dated February 17, 1841, about which time my interest in the subject was first excited.

¹⁵ Of course this never occurs in Birds, where the Malpighian vessel is a coiled ampulla

occurred into the capsule, the fluid has not spread itself over the whole surface of the tuft, and yet has passed off along the tube (figs 3, 10, m, m). As the tubes in the human kidney usually become very tortuous immediately on leaving the Malpighian bodies, the injection running off along them may often wear the appearance of an irregular extravasated mass, and so its real nature escape observation¹⁶ (p 68) (fig 9). When size and ver-

16 During the course of the researches detailed in this paper, I have embraced whatever opportunities presented themselves of studying the morbid conditions of the human kidney, and especially those usually known as the stages of Bright's disease obviously have been little conducive to my present purpose to have entered here upon a general description of the results to which my inquiries on this interesting subject have led me, but I cannot forbear noticing one fact of considerable importance, which will both illustrate and be illustrated by the preceding account of the normal anatomy of the gland It is well known that blood is often passed with the urine during the course of the disease, especially at the earlier periods of it, when many circumstances contribute to prove that the kidneys are in a state of sanguineous turgescence How does this blood escape into the ducts of the gland? The organ examined at this time presents on its surface and throughout its cortical substance, scattered red dots, of somewhat irregular shape, not accurately rounded, and generally as large as pins' heads, that is, very many times larger than the Malpighian bodies These spots are very visible on the surface, where, as I have before stated (p 62), no Malpighian bodies exist. They have been nevertheless described by several recent writers (not without contention for the honour of the discovery) as Malpighian bodies enlarged from congestion How a Malpighian tuft, such as I have described it, could attain so prodigious a bulk, prodigious compared with its natural size, it would not be easy to explain. It is true that, if examined with a lens, the blood forming these spots is found to be arranged in convoluted lines, but these convolutions are not the dilated vessels of the tuft They are nothing less than the convolutions of a tube filled with blood, that has burst into it from the gorged Malpighian tuft at its extremity This is at once evident to a person familiar with the appearance of the same tubes when filled with injection in a similar manner, and the figure, which I have taken from a healthy kidney so injected (fig 11), might serve as an exact representation of one of these spots, as seen on the surface of the diseased organ. The more or less perfect plug, thus often formed in the tubes, is the occasion of those dilatations of the tubes and Malpighian capsules, which are to be met with in the more advanced stages of Thus is to be explained the somewhat loose statement, that the disease consists essentially in enlargement of the Malpighian bodies Though I have examined with great care many kidneys at all stages of the complaint, I have never seen, in any one instance, a clearly dilated condition of the Malpighian tuft of vessels On the contrary, my friend, Mr Busk, an excellent observer, has specimens which undoubtedly prove these tufts not to be dilated in the first stage, and I possess injected specimens showing them at all stages, but never above their natural size I am far from implying, however, that these bodies are unconcerned in the train of morbid phenomena. They unquestionably are so, and even necessarily must be so, from their anatomical structure, but in what manner I shall not at present attempt to show

milion are employed, this is very apt to occur,17 and especially when the specimen injected is not fresh, for the epithelium soon loses its adhesion to the basement tissue of the tube, and, falling into the cavity, mingles with the stream of injection, and renders its course obscure This lining of the tubules with a pavement of epithelium occasions a striking appearance in perfectly fresh specimens, when filled with double injection This penetrating material insinuates itself into the interstices of the epithelial particles, and thus marks them out as a kind of pattern on the wall of the tube When extravasation does not take place in the Malpighian bodies, more or less of the network surrounding the tubes is not unfrequently injected. The most perfect specimens of injected Malpighian tufts are then obtained, but the veins themselves are seldom well filled through the arteries, for not only is the way to them circuitous, and broken up into a thousand separate avenues (the Malpighian tufts), but it is usually loaded with blood When injection is driven into any one branch of the renal artery, the several states now detailed are seen only in the parts to which that branch is distributed There is no anastomosis between the branches in the interior of the gland

It sometimes happens that in injections by the artery, extravasation is found to take place into the interstices of the tubes, with or without escape into the Malpighian capsules and tubes. This may arise from rupture either of the arterial tree, before reaching the Malpighian bodies (which is uncommon, where great force is not employed), or of the efferent vessels of those bodies, or of the network of the tubes, injected through them. It may also occur from rupture of a tube, which has been itself filled by the rupture of a Malpighian tuft.

17 My friend Mr Quekett, of the College of Surgeons, possesses many very excellent specimens of injected kidneys, in many of which he has been able to detect the tube passing from the Malpighian body, since his attention was directed to this arrangement. He also showed me a very beautiful injection of the Malpighian bodies in the Horse, sent over to the Microscopical Society of London by Prof. Hyrtl of Prague. In one corner of this we found a similar extravasation, though the disposition in question seems to have eluded the attention of that excellent anatomist. I am indebted to Mr. Quekett for some finely injected specimens of a boa's kidney, from one of which fig. 14, is taken

By the Veins, the Capillaries surrounding the tubes may be injected, but neither the Malpighian bodies, nor the aiteries, nor, without extravasation, the tubes

The capillaries of the uriniferous tubes are of great aggregate capacity, and commonly contain much blood When injection is pushed into the vein the whole organ instantly swells, so rapidly do these dilatable and freely mosculating channels receive the fluid impelled into them By the numerous communications of the capillaries with the veins, it is at once dispersed in every direction, and enters the capillaries (p 69) by innumerable avenues But towards the Malpighian bodies, there is no opening from this capillary network at all corresponding in magnitude or freedom to that on the side of the veins the only points by which it can discharge itself are the efferent vessels of the Malpighian bodies, which are comparatively few in number, only capillary in size, and quite disconnected with one another, except through the plexus itself Add to this, that the Malpighian tuft to which they lead is a great obstacle to the passage of fluid, from the tortuosity of its minute vessels, and by their all having but one point to discharge themselves of the blood they already contain, viz their afferent vessel. Thus to fluid driven through the kidney in a retrograde course, there is not only the general impediment offered by the aggregate capacity of the arteries being greatly inferior to that of the veins, but a vascular arrangement equivalent to a double valve The capillaries of the tubes form a first great cul-de-sac, those of the Malpighian tufts a second, for these may both be described as great reservoirs, easily entered from the side of the arteries, but discharging themselves with great difficulty back again, or towards the arterial tree If it be now considered that the network of the tubes, or the former and far the greater of these reservoirs, almost always retains much blood after death, and that the Malpighian reservoir is never without a considerable quantity, it will not be difficult to comprehend, why injection thrown into the veins reaches not to the Malpighian bodies, however well it may seem to load the capillaries of the tubes; for all the blood must first pass through the difficult channels

that have been spoken of, and this it never can do completely. I suppose that this view of the subject, which is nothing more than a statement of facts, will be deemed a sufficient explanation, and that it will not be regarded as necessary to imagine the existence of real valves in any part of the course of these small bloodvessels. I have never met with any appearance that could lend credibility to such a supposition, which, if true, would present an unique structure in the vascular system. Extravasation from the veins will sometimes reach the tubes, in consequence of a structure which will presently be explained.

By the Tubes, the Malpighian bodies cannot be injected, nor, without extravasation, either the plexus surrounding the tubes, or the veins

Many anatomists have taken extreme pains to inject the tubes from the pelvis of the kidney, by means of the air-pump, but never has a single Malpighian body been thus filled This, it has been said, is a conclusive proof that the Malpighian bodies are not placed at the extremities of the tubes But I think that if the real structure and relation of these parts be duly considered, this constant result will be allowed to be in the strictest accordance with the account I have delivered, and even a necessary effect of the anatomical disposition of the parts To those who are acquainted with the practical difficulties of the injection of the ducts of glands in general, and especially of those which are very tortuous, the following considerations on this subject (p 70) will probably appear conclusive Even of the testis (where the tubes are far thicker and stronger in their coats, and much more capacious than in the kidney), there are not ten specimens that can be pronounced at all full, in the museums of Europe, and there is no evidence, that, even in the best of these, the injected material has reached the very extremities of the tubes

In the kidney, the tubes are exceedingly tortuous after leaving the Malpighian bodies, and only become straight, in most animals, in proceeding towards the excretory channel to discharge themselves The way towards their orifices is so free, in a natural state, that their fluid contents exert no distending force

upon their walls Accordingly their walls are exceedingly feeble, the basement membrane on which their strength mainly depends, is very delicate and easily torn They are therefore incapable of offering much resistance to a fluid impelled into them from the pelvis, but burst readily, if it be forcibly urged were the coats ten times as tough as they really are, injection could not penetrate far into their convoluted portion, unless pushed with much force, and this for two reasons -ist The fluid which the tubes already contain has no means of escape before the injection, since these canals end by blind extremities in the Malpighian bodies, and though these bodies are dilatations of them, yet they are already filled almost completely by the tuft of capillaries, and offer no capacious receptacle for the fluid from the tubes 2nd The layer of epithelium (which usually forms about two-thirds of the thickness of every tube, the calibre being about one-third18) is, immediately after death, very prone to separate from the basement membrane which it lines, and to fall into and block up its narrow channel Even if the epithelium remains in its place, the calibre of the tube is but small, and if it becomes detached, it opposes an effectual bar to the progress of the injection By removing the pressure of the atmosphere from the outer surface of the tubes, these obstacles are occasionally in part overcome, so that even the tortuosities of the tubes are filled for a certain distance. But even so limited a success is rate, and in face of mechanical obstacles, such as above mentioned, to the onward current of the injection in the tubes, the force employed invariably sooner or later bursts their coats, ere their extremities have been reached Extravasation from the tubes, as might be expected, fills their interstices, and the fluid may then issue by a rent at the hilus of the kidney But it is remarkable how readily it enters the veins and absorbents from the ducts This is undoubtedly by extravasation, and does not prove any continuity between them The veins may be filled when the fluid has not penetrated in the tubes beyond the medullary cones, showing that the rupture must occur in

¹⁵ These proportions vary considerably The basement membrane is so thin that it may be left out of the estimate

connection with those cones, either at their apices or in their sub-By a thin tranverse section of one of these cones, the ducts and blood-vessels of which they principally consist, are seen to be imbedded in a sort of matrix, apparently homogeneous, but probably having a cellular structure. This matrix keeps the tubes and (p 71) vessels open by being united to their outer coat, whence results the dark colour, usually attributed to congestion, which these cones commonly present, as compared with the cortical part, where this matrix is less abundant This is the structural condition which seems to me most easily to explain the remarkable facility with which injection, urged along the tubes, enters the veins The smallest rupture of the matrix will crack across the minute vessels accompanying the tubes, and expose their open extremities to the entrance of the injec-If the force employed be very moderate and equable, extravasation does not occur, and the tubes alone are injected, often to the surface, but undue or ill regulated pressure almost inevitably occasions it Having once entered a small vein, through however small an opening, it soon diffuses itself through the veins, and the capillaries surrounding the tubes, rather than along the tubes, for the reasons above stated, and, if the organ be then cut to pieces and examined, these vessels seem filled, without extravasation, the tubes are also more or less filled with the same colour, and the two structures are so intricately interlaced, as to wear the aspect, especially if dried, of one continuous network The point of extravasation escapes observation, and hence the fallacy of imagining a continuity between the veins or their capillaries, and the tubes

Some distinguished anatomists have held that the tubes end in a plexiform manner, and have stated themselves to have unequivocally seen this arrangement in injected specimens. I am induced to believe this opinion to be founded on deceptive appearances, either such as that above mentioned, or that occasioned by the overlapping of injected tubes. Others have considered the tubes to terminate in free blind extremities unconnected with the Malpighian bodies, and have likewise rested their opinion on the appearances of injected specimens, as well

as on those of recent ones As the injection always stops short of the real extremities of the tubes (the Malpighian bodies), it must necessarily show apparent free extremities—and others may be produced by the section requisite for the examination of the part As for the false appearances presented by recent specimens, they are obviously referable to the sudden bending down of a tube behind the part turned to the observer composed of convolutions, many such must continually occur, and their real nature may be easily determined by the use of a high power and varying focus Other anatomists, aware of this fallacy, and failing to find either a free mosculation of the tubes in the form of a plexus, or a termination of them in the Malpighian bodies, have rested in the conclusion that the curves of the convoluted part are the looped junctions of different tubes It is obvious that this conclusion is a deduction drawn from the apparent absence of any other mode of termination, and must be relinquished now that the tubes are shown to end in the Malpighian bodies

The foregoing account has been drawn principally from my observations on the kidneys of Mammalia, but it is intended to embrace the chief points in the anatomy of the Malpighian bodies in all the Vertebrate tribes In all these, I have ascertained (72) the Malpighian body to consist of the dilated extremity of the uriniferous tube, with a small mass of bloodvessels inserted into But in the several orders of animals, there are various modi-The most considerable of these fications that merit notice regard the size of the Malpighian bodies, in connection with which are others in the mode of division of the arterial twig The Table exhibits this variety in their size, in a few species, and subjoined to each measurement, is that of the tube soon after its emergence It will be seen that the tubes differ far less than the Malpighian bodies The kidney of the Boa shows very beautifully the reason of the different size of the Malpighian bodies in different parts of the same gland observed in all animals, and also one cause of the striking difference in their size in different animals, and especially in different-sized animals of the same

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Table of the Diameter of Malpighian Bodies, and of the Tubes Emerging from Them in Fractions of an English Inch

	Diameter	Diameter of Malpighian bodies		
	Maximum	Mean	Mınımum	Diameter of tubes
Man	<u> 1</u>	<u> </u>	<u> </u>	
	80	104	144	480
Badger	<u> 1</u>	<u> </u>		<u>I</u>
	104	124	150	416
Dog	<u> </u>	<u> </u>	<u> </u>	<u> </u>
	120	155	156	600
Lion	1	<u> </u>	<u> 1</u>	1
	70	80	90	312
Cat	<u> 1</u>	1	I	1
	156	200	250	680
Kitten	<u>I</u>	I	<u> </u>	<u> </u>
	208	260	312	1000
Rat	<u> 1</u>	<u> 1</u>	<u> 1</u>	1
	208	180	150	416
Mouse (Mus)	<u> 1</u>	<u> </u>	<u> </u>	<u> </u>
	220	255	312	770
Squirrel (Sciurus vulgaris)				
		207		770
Rabbit (Lepus Cuniculus)	Ì	I		I
		156		625
Guinea Pig (Cobaya)		I		1
		208		600
Horse	1	I	I	I
	55	70	90	416
Parrot (Psittacus)		<u>I</u>		I 1
		430	1	600 to 70
Tortoise (Testudo)	1	1	1	I
		240		480
Воа	<u> </u>	I	1	I
	230	400	540	540
Frog (Rana)		<u> </u>		
		250		
Fol (Amoulla pulgares)				
Eel (Anguilla vulgaris)		207		

natural group Its lobes are much thinner at their convex border, opposite the hilus, than elsewhere The tubes are consequently much shorter there, and I have remarked that the

Malpighian tufts are also much smaller. This correspondence between the size of the Malpighian bodies and the length of the tubes, throws much light on the function of the former. A further study of the varieties here displayed in the size of the Malpighian tufts seems highly desirable.

(p 73) Reflecting on this remarkable structure of the Malpighian bodies, and on their singular connection with the tubes, I was led to speculate on their use. It occurred to me that as the tubes and their plexus of capillaries were probably, for reasons presently to be stated, the parts concerned in the secretion of that portion of the urine to which its characteristic properties are due (the urea, lithic acid, &c), the Malpighian bodies might be an apparatus destined to separate from the blood the watery portion. This view, on further consideration, appears so consonant with facts, and with analogy, that I shall in a few words state to the Society the reasons that have induced me to adopt it. I am not unaware how obscure are the regions of hypothesis in physiology, and shall be most ready to renounce my opinion, if it be shown to be inconsistent with truth

In extent of surface, internal structure, and the nature of its vascular network, the membrane of the uriniferous tubes corresponds with that forming the secreting surface of other glands Hence it seems certain that this membrane is the part specially concerned in eliminating from the blood the peculiar principles found in the urine To establish this analogy, and the conclusion deduced from it, a few words will suffice I The extent of surface obtained by the involutions of the membrane, will by most be regarded as, itself, sufficient proof But, 2 Its internal struc-Since epithelium has been found by Purkinje ture is conclusive and Henle in such enormous quantities on the secreting surface of all true glands, its use cannot be considered doubtful never forms less than 19/20ths of the thickness of the secreting membrane, and in the liver it even seems to compose it entirely, for there I have searched in vain for a basement tissue, like that which supports the epithelium in other glands As I have endeavoured to show in the forthcoming Number of the Cyclopaedia of Anatomy, the epithelium thus chiefly forming the substance of secreting membrane, differs in its general characters from other forms of this structure. Its nucleated particles are never clothed with cilia, and are not surrounded with a definite cell-membrane. They are more bulky, and appear from their refractive properties to contain more substance, their internal texture being very finely mottled, when seen by transmitted light. In these particulars, the epithelium of the kidney-tubes is eminently allied to the best-marked examples of glandular epithelium. 3 The capillary network surrounding the uriniferous tubes is the counterpart of that investing the tubes of the testis, allowance being made for the difference in the capacity of these canals in the two glands. It corresponds with that of all true glands in lying on the deep surface of the secreting membrane, and in its numerous vessels everywhere anastomosing freely with one another.

These several points of identity may seem too obvious to be dwelt upon, but I have detailed them in order to show, that in all these respects, the Malpighian bodies differ from the secreting parts of true glands I The Malpighian bodies comprise but a small part of the inner surface of the kidney, there being but one 2 The epithelium immediately changes to each tortuous tube its characters, as the tube (p 74) expands to embrace the tuft of vessels From being opake and minutely mottled, it becomes transparent, and assumes a definite outline From being bald, it becomes covered with cilia (at least in reptiles, and probably in all classes), and, in many cases, it appears to cease entirely, a short way within the neck of the Malpighian capsule blood-vessels, instead of being on the deep surface of the membrane, pass through it, and form a tuft on its free surface stead of the free anastomosis elsewhere observed, neighbouring tufts never communicate, and even the branchlets of the same tuft remain quite isolated from one another

Thus the Malpighian bodies are as unlike, as the tubes passing from them are like, the membrane, which, in other glands, secerns its several characteristic products from the blood. To these bodies, therefore, some other and distinct function is with the highest probability to be attributed

When the Malpighian bodies were considered merely as convoluted vessels without any connection with the uriniferous tubes, no other office could be assigned them, than that of delaying the blood in its course to the capillaries of the tubes, and the object of this it was impossible to ascertain. Now, however, that it is proved that each one is situated at the remotest extremity of a tube, that the tufts of vessels are a distinct system of capillaries inserted into the interior of the tube, surrounded by a capsule, formed by its membrane and closed everywhere except at the orifice of the tube, it is evident that conjectures on their use may be framed with greater plausibility

The peculiar arrangement of the vessels in the Malpighian tufts is clearly designed to produce a retardation in the flow of the blood through them. And the insertion of the tuft into the extremity of the tube, is a plain indication that this delay is subservient in a direct manner to some part of the secretive process

It now becomes interesting to inquire, in what respect the secretion of the kidney differs from that of all other glands, that so anomalous an apparatus should be appended to its secerning tubes? The difference seems obviously to lie in the quantity of aqueous particles contained in it, for how peculiar soever to the kidney the proximate principles of the urine may be, they are not more so than those of other glands to the organs which furnish them.

This abundance of water is apparently intended to serve chiefly as a menstruum for the proximate principles and salts which this secretion contains, and which, speaking generally, are far less soluble than those of any other animal product. This is so true, that it is common for healthy urine to deposit some part of its dissolved contents on cooling. It may seem that an exception to this exists in the solid urine of some reptiles, but this expression merely describes the urine as it is found in the cloaca and larger excretory channels. The secretion is brought from the tubules of the gland in a fluid state, and only becomes solid by the re-absorption of its aqueous portion after it has traversed the tortuous canals wherein it was formed, and been

placed in a condition to be readily expelled from the system. The subordination of the aqueous part to the purpose of eliminating the more essential elements (p. 75) of the secretion from the secerning tubules of the gland, is therefore here placed in a clear light

If this view of the share taken by the water be correct, we must suppose that fluid to be separated either at every point of the secreting surface, along with the proximate principles, as has hitherto been imagined, or else in such a situation that it may at once freely irrigate the whole extent of the secerning membrane. Analogy lends no countenace to the former supposition, while to the latter, the singular position, and all the details of the structure of the Malpighian bodies, give strong credibility.

It would indeed be difficult to conceive a disposition of parts more calculated to favour the escape of water from the blood, than that of the Malpighian body A large artery breaks up in a very direct manner into a number of minute branches, each of which suddenly opens into an assemblage of vessels of far greater aggregate capacity than itself, and from which there is but one narrow exit Hence must arise a very abrupt retardation in the velocity of the current of blood The vessels in which this delay occurs are uncovered by any structure They lie bare in a cell from which there is but one outlet, the orifice of the tube orifice is encircled by cilia, in active motion, directing a current towards the tube These exquisite organs must not only serve to carry forward the fluid already in the cell, and in which the vascular tuft is bathed, but must tend to remove pressure from the free surface of the vessels, and so to encourage the escape of their more fluid contents Why is so wonderful an apparatus placed at the extremity of each uriniferous tube, if not to furnish water, to aid in the separation and solution of the urinous products from the epithelium of the tube?

Many recently discovered facts19 conspire to prove that secre-

¹⁹ Purkinje, Report of the Meeting of Naturalists at Prague in 1837, Isis, No 7, 1838 Schwann, Froriep's Notiz Feb 1838 Henle, Muller's Archiv 1838-9 (See also Cyclop of Anatomy, Art *Mucous membrane*, the conclusion of which is only just published, although that part of it relating to this theory was written in December last Mr Good-

tion is a function very nearly allied to ordinary growth and nutrition, that whereas growth and nutrition comprehend two functions, assimilation of new particles and rejection of old, the old being reconveyed into the blood, so secretion consists in a corresponding assimilation and rejection, and only differs in the old particles being at once thrown off from the system, without re-entering the blood According to this view, all effete material received into the blood from the old substance of the various organs, must be reassimilated by an organized tissue, specially designed for the purpose, before it can be (p 76) eliminated and all secretions designed for an ulterior use in the oeconomy must be assimilated by such a tissue in order to their separation from the blood This tissue is the epithelium of such surfaces, as, from their external anatomical position, can at once release the secretion, when its elaboration is accomplished The epidermis of the skin, the epithelium of mucous membranes, and that of true glands, all more or less completely fulfil this purpose, but the first is chiefly designed as a protection, the second partly so, and the third is the only one entirely devoted to what is properly called secretion Into the examination of this general question, it is impossible that I should now enter, but I shall state some considerations connected with it, that seem to have a bearing on the present subject

This theory, in its widest sense, supposes the epithelium of secreting surfaces either to pass through constant stages of renovation and decay, or else to remain, during a longer period, as a permanent organic form, assimilating and rejecting, in the mode just described. In many cases the epithelial particles appear to

sir, since this paper was read, has ably advocated this theory in a communication made to the Royal Society of Edinburgh on the 30th of March, an abstract of which I have just seen in the London and Edinburgh Monthly Journal of Medical Science, May 1842 In the same publication is a report of a paper by the same excellent anatomist, on the structure of the kidney, read at the Med Chir Soc of Edinb on April the 6th He describes "a fibro-cellular framework, pervading every part of the gland"—analogous to the capusle of Glisson, and "forming small chambers in the cortical portion, in each of which a single ultimate coil or loop of the uriniferous ducts is lodged" This framework is the structure which I have described (pp 70-1) as the matrix The convoluted tubes and vessels are all imbedded in it—June 1, 1842)

be cast off entire when their growth is complete, and thus to form the secretion, in other instances, they seem to lose their substance by a more gradual process, and to waste or dissolve away on the surface of the membrane, as fresh particles are deposited below, in other examples still, there is reason for believing that they are long a persistent structure. It supposes that the elements of all natural secretions have at one time been a part of an organized form, the epithelial particle, but it leaves it uncertain, whether the secretion, in a complete state, always exists in such particles when alive. It does not determine whether the chemical changes which occur in such particles, issue in the completion of the secreted product, until the period arrives for its being shed from the body. Hence it is beyond the reach of objections founded on the chemical examination of glandular organs en masse.

Applying this theory to the kidney, it may be considered highly probable that the epithelium of the uriniferous tubes is continually giving up its effete particles, and undergoing a gradual decay. This view harmonizes in a striking manner with what has been before advanced as to the use of the Malpighian bodies. If the peculiar urinous principles were poured out at once, through the walls of the tubes by the capillaries surrounding them, they must be in a dissolved state from the first, and could need no further aqueous current to carry them off, but if they are deposited in a more or less solid form, as a part of an organized tissue, they will require (being so sparingly soluble) an additional and extraneous source of water, by which, when their formation is complete, they may be taken up and conveyed from the gland. The correspondence before noticed (p. 72) between the size of the Malpighian bodies and the length of the tubes coming from them, is a strong argument in favour of this view.

I stated that the large quantity of water in the urine seemed chiefly to serve the purpose of a menstruum. But though this quantity is always large, compared with that in other secretions, it is liable to great variation, according to the state of fulness (p. 77) of the vascular system, and other circumstances. Hence the kidneys appear to share in the office of regulating the amount of water in the body. How admirably the structure

of the Malpighian bodies fits them for thus acting as a self-adjusting valve or sluice to the circulation, I need not explain

It may possibly be considered by some, that, in the preceding observations on the use of the aqueous element of the urine, and on the nature of secretion in general, I have been endeavouring to illustrate a doubtful hypothesis by speculations more doubtful still, obscurum per obscurius But I rest my view of the function of the Malpighian bodies principally on anatomical grounds, and the other considerations have been introduced in connection with it, rather in consequence of the interest they appear to me to add to it, than because I am fully satisfied of their validity Undoubtedly both questions are worthy of being separately handled, and require a much wider and more elaborate investigation than seems yet to have been given them Meanwhile they may in turn receive some elucidation from the researches detailed Parallel lines of inquiry into the anatomical variein this paper ties of the Malpighian bodies and uriniferous tubes, and into the chemistry of their secretion, in the different tribes of animals and in various stages of their development, could scarcely fail either to confirm or to confute what has now been advanced

I shall conclude with three remarks founded on the foregoing facts and speculations

The bile and the urine have been ever classed together as the most important excretions. The former is secreted from venous blood, the latter it has been thought from arterial blood, except in some inferior animals, in which the blood from the lower part of the body circulates through the kidneys. But it is a most striking fact, that the proximate principles of the urine, like those of the bile, are secreted in all animals from blood which has already passed through one system of capillaries, in a word, from portal blood, although it does not appear to what extent its qualities are changed by traversing the Malpighian system. The analogy is at least remarkable, and may throw some light on the mysterious meaning of the portal circulation.

2 Divietic medicines appear to act specially on the Malpighian bodies, and various foreign substances, particularly salts, which, when introduced into the blood, pass off by the urine with great

freedom, exude in all probability through this bare system of capillaries. The structure of the Malpighian bodies indicates this, and also, as far as they are known, the laws regulating the transmission of fluids through organized tissues, modified in their affinities by vitality

3 The escape, also, of certain morbid products, occasionally found in the urine, seems to be from the Malpighian tufts. I allude especially to *sugar*, *albumen*, and *the red particles of the blood*: the two first of which would transude, while the last would escape only by rupture of the vessels ²⁰

3 Norfolk Street, Strand, February 14th, 1842.

EXPLANATION OF PLATE I

Fig I Malpighian tust—Horse The injection has penetrated only to the capillaries a The artery as One of its terminal twigs (or the afferent vessel of the Malpighian body) d The dilatation and mode of breaking up of the terminal twig, after entering the capsule the division of the tust into lobes l, l, l, l, is well seen i, i Intervals between the lobes Magnified about eighty diameters

Fig 2 Malpighian tuft—Horse The injection has penetrated through the tuft and has filled the efferent vessel, here coloured yellow for distinctness' sake af The afferent vessel d Its dilatation and mode of division m, m Malpighian capilaries ef Efferent vessel springing from them, and leaving the capsule between two primary branches of the afferent vessel Magnified about eighty diameters

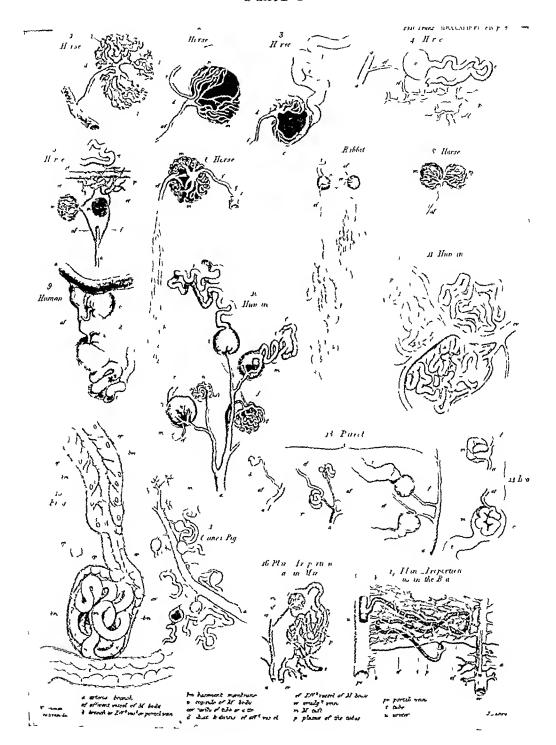
Fig 3 Malpighian body—Horse The injection, after filling the primary branches of the afferent vessel, has burst into the capsule and passed off along the tube. It has not filled the tuft of capillaries, which consequently are not seen, nor has it spread within the capsule over the whole surface of the tuft af The afferent vessel d Its dilatation and mode of subdivision c, c. The outline of the distended capsule t. The tube passing from it t. Situation of the uninjected Malpighian tuft. Magnified about seventy diameters

Fig 4 From the Horse The injection has penetrated from the artery, through the Malpighian tuft, into the plexus surrounding the tubes. It has then ruptured the vessels of the tuft, filled the capsule, and passed off along the tube a Arterial branch af Afferent vessel c Capsule distended t Tube ef Efferent vessel p Plexus of capillaries, surrounding other tubes not injected. Magnified about thirty diameters

Fig 5 From the Horse The injection has passed as in the last-described

²⁰ See Note, p 67

PLATE I



specimen, but without rupture of the Malpighian tuft a Branch of the artery af, af Afferent vessels m, m Malpighian tufts ef, ef Efferent vessels p Plexus surrounding the tubes st Straight tube in cortical substance ct Convoluted tube in ditto Magnified about thirty diameters

Fig 6 From the Horse Malpighian tuft, from near the base of one of the medullary cones, injected without extravasation, and showing the efferent vein branching like an artery, as it runs into the medullary cone a Arterial branch af The afferent vessel m, m The Malpighian tuft ef The efferent vessel b Its branches entering the medullary cone Magnified about seventy diameters

Fig 7 Similar specimens from the Rabbit, but with extravasation into the capsule, and at 6 into the tube also af, af Afferent vessel c, c The capsule t The tube ef, ef The efferent vessel b, b Its branches entering the medullary cone Magnified about thirty diameters

Fig 8 From the Horse Two Malpighian tufts springing close together from a single terminal twig of the artery An unusual arrangement af Afferent vessel m, m Malpighian tufts Magnified about thirty diameters

Fig 9 From the human subject. Two Malpighian bodies injected. The tufts are burst and the fluid has escaped into the capsule. In one case it has passed also along the tube, the extreme tortuosity of which at its commencement, is well seen. a Arterial branch af Terminal twigs. c, c Malpighian capsules distended. de The depression often seen in such cases, at the point where the afferent and efferent vessels pass, the latter are not here injected t. The tube. Magnified about ninety diameters.

Fig 10 From the human subject. This specimen has been chosen because it exhibits the termination of a considerable arterial branch, wholly in Malpighian tufts, and because the several Malpighian bodies injected show different appearances of a very instructive kind a Arterial branch with its terminal twigs. At α the injection has only partially filled the tuft. At β it has entirely filled it, and has also passed out along the efferent vessel ef, without any extravasation. At γ it has burst into the capsule and escaped along the tube ef, but has also filled the efferent vessel ef. At ef and ef it has been extravasated and passed along the tube. At ef and ef (as in fig. 3) the injection on escaping into the capsule has not spread over the whole tuft. Magnified about forty-five diameters

Fig 11 A minute portion of the surface of the human kidney, injected from the artery. The injection has burst many Malpighian tufts within the cortical substance, and so filled the tubes, the convolutions of which on the surface of the organ are here displayed. It has also traversed other Malpighian tufts without extravasation, and so filled the capillary plexus surrounding the tubes and some radicles of the vein 1, 1 Tortuous tubes as seen on the surface these, with their capillaries, cover the surface, so that no Malpighian bodies appear p Capillary plexus surrounding the tubes, as seen on the surface ev A branch of one of the stelliform veins. Magnified about forty-five diameters

Fig 12 From the Guinea Pig (Cobaya) Terminal branch of the renal artery

The injection has burst most of the Malpighian tufts and passed off along the tubes a Arterial branch At m are seen a few Malpighian tufts partially injected without extravasation Magnified about forty diameters

Fig 13 From the Parrot (Psittacus) Injected by the artery a, a, a Terminal branches of the artery af, af, af Terminal twigs of the artery Dilatation (80) of the terminal twig on entering the Malpighian capsule This dilatation more completely filled, showing its convoluted form, and ef the efferent vessel c The Malpighian capsule filled, by extravasation from the contained vessel, and the tube 6 likewise filled The same, with the efferent vessel ef, also filled Magnified about eighty diameters

Fig 14 From the Boa Constrictor Injected by the artery af, af Terminal twigs of the artery m, m The convoluted dilated part within the Malpighian capsule ef The efferent vessel c. The capsule—visible, but not injected t The commencement of the tube Magnified about seventy diameters

(All preceding figures are viewed by reflected light)

Fig 15 From the Frog, viewed by transmitted light Shows the continuity of the Malpighian capsule with the tube, the change in the character of the epithelium, and the vascular tuft bm, bm Basement membrane of the tube ep, ep Epithelium of the tube cav Cavity of the tube bm', bm' Basement membrane of the capsule ep', ep' Epithelium of the neck of the tube, and of the neighbouring part of the capsule this epithelium is covered with cilia, which were seen in active motion eight hours after death epithelial particle, more highly magnified, showing the relative length of the cilia, as they appeared in this specimen cav' Cavity of the capsule, in which the capillaries, m, lie bare, having entered the capsule near t, where the view is obscured by another tube Magnified about 320 diameters

Fig 16 Plan of the renal circulation in Mammalia The relative proportions and the character of the several parts are accurately copied from preparations of the Human kidney The artery a, (coloured pink) is seen giving a terminal twig af, to a Malpighian tuft, m, from which emerges the efferent (or portal) vessel ef (coloured yellow) Other efferent vessels are seen, e, e, e All these enter the plexus of capillaries p (coloured blue) surrounding the uriniferous tube t (coloured red) From this plexus the emulgent vein ev springs Supposed to be magnified about forty diameters

Fig 17 Plan of the renal circulation in animals furnished with a portalvein from an extraneous source The colours correspond with those of fig 16 relative proportions and position are copied from the kidney of the Boa (p 64), of which a vertical section of one half of a lobe is supposed to be made Artery af Terminal twig going to the Malpighian body ef Efferent vessel of the Malpighian body emptying itself into a branch of the portal vein po on the surface of the lob b, b Ultimate branches of the portal vein, entering the capillary plexus p, surrounding the uriniferous tube t u Branch of the ureter on the surface of the lobe ev Emulgent vein within the lobe, receiving the blood from the plexus surrounding the uriniferous tubes Supposed to be magnified about forty diameters



Lectures on the Parts Concerned in the Operations of the Eye, and on the Structure of the Retina

BY

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Lecture I

GENERAL VIEW OF THE EYEBALL—ITS SIZE, SHAPE, AND TENSION—STRUCTURE OF THE SCLEROTICA—IMPLANTATION OF THE RECTI—THICKNESS AT DIFFERENT PARTS OF THE CORNEA—SHAPE—SURFACES—THICKNESS—IS IT A LENS? OF THE LAMELLATED TISSUE—Number of Superposed Lamellae—Tubular Interstices—Union with Sclerotica Anterior Elastic Lamina—How Tied Down—Conjunctival Epithelium—Posterior Elastic Lamina—Marginal Plexiform Tissue—Its Triple Distribution—Circular Sinus—Epithelium of the Aqueous Humor



ENTLEMEN,—The benevolent founders and supporters of this hospital have ever been desirous that it should not merely minister (as it does so largely) to the relief of the poor of the metropolis and surrounding counties, but that its ample resources should be employed as

means of instructing the rising generation of medical men in the very important class of diseases which are daily treated within

its walls I need not inform you particularly of the share it has had in enlarging and diffusing the knowledge of ophthalmic diseases. It will be enough that I refer, as evidence on that point, to the names of Saunders, Farre, Travers, Lawrence, and Tyrell,—the distinguished men who, for more or less of the first forty years of its existence, were the instruments of its usefulness, and the main source of that amount of celebrity which it has acquired. Of these we can still number but one amongst our present colleagues: and I cannot mention the name of Dr Farre, without a passing acknowledgment (p. 2) of what this institution owes to him, and of the honour I feel it to be associated with one so venerable and respected ¹

It is our wish, according to our ability, to continue to make the Ophthalmic Hospital subservient to the same ends as heretofore. The number of patients considerable exceeds that at any former period, being now upwards of 7000 annually, and these afford the means of studying on a great scale the several forms of disease which attack the complex and important organ of sight ²

The lectures which we offer are not intended to supersede the necessity of your observing, each one for himself, with minute and accurate attention, the realities of disease and the effects of remedies, but rather, by opening the subject, and acquainting you with the general outlines, to remove the first difficulties from your path, and to stimulate your minds with a fore-taste of the pleasure which all will certainly experience, who devote themselves to the earnest pursuit of knowledge in the field before us

In the arrangements for the present season the task has devolved upon myself of giving you some account of certain structures of the eye-ball, which are of primary consequence to the practitioner, as being those involved in the operations he will be called on to perform, and also as being the seat of several of

¹ To these distinguished names must be added that of Mr Dalrymple, who is now returns from the Institution after a service of nearly twenty years, during which he has contributed to raise its character by his excellent work on the Anatomy of the Eye, published in 1836, and who is about still further to extend its reputation by an admirable series of coloured illustrations of the diseases of the eye

² In 1848, upwards of 8000

the more common, as well as severe, morbid actions which affect the organ That you may form some estimate of the importance of that class especially which belongs to the cornea, I may mention a circumstance which I remarked with concern during a visit to that noble institution, the School for the Indigent Blind, in St George's Fields It was this—that a very large number of all the cases of total and irremediable blindness which those walls receive are the result of inflammations of the front of the eye, its transparent inlet having been darkened or destroyed by the ravages of disease, which we are quite sure might, in a great majority of instances, have been controlled by skilful and timely (p 3) treatment These cases occur amongst the poor—a class to whom the eye is, if possible, even more valuable than to the rich, because without it they can hardly obtain their daily bread, or enjoy the common comforts of existence,—a class, too, among whom it is probable that most of you will be called on to minister during the early years of your professional life More than this, I think, need not be said to impress you with the importance of the subject which is about to engage our attention

It would be easy to expatiate on the utility of an exact knowledge of the structure of the body to one who desires to study that body in its morbid states, but I am willing to hope that such an argument would be almost superfluous, and at any rate, (that I may not detain you any longer on introductory topics) I shall content myself with observing, that, though a man of genius has now and then become a great physician, like Hippocrates or Sydenham, by an acute and persevering observation of disease, and of the effects of remedies, and without much acquaintance with anatomy, yet that the common voice of mankind proclaims that he who best knows the mechanism of the body will, with a like study of the other departments of medicine, be the best able to comprehend the actions of that body, both in health and disease

General view of the eyeball—The eyeball, gentlemen, as you know, consists primarily and essentially of a sheet of nervous matter visually endowed,—that is, capable of being so affected by light, that, when duly connected with the sensorium, what we

call sight, or perception of light, is the result This sheet, which we term the retina, is brought towards the surface of the body to meet its appropriate stimulus, and the commissure of nervous substance which connects it to the brain and to the opposite retina is called the optic nerve In front of the retina are placed transparent media, which, as a whole, refract the light so as to bring it to a focus on the nervous layer, which is spread out in a concave form to receive the more perfect image The retina is supported behind by a firm resisting tunic, the sclerotica, which is prolonged in front of the transparent media, as a transparent, partly integumental membrane, the cornea Between retina and the sclerotica is a very vascular membrane, of a dark brown colour, the choroid, which is advanced behind the cornea under the form of a vertically-hung contractile curtain, the iris, in the centre of which is an aperture, the pupil, capable, by varying its size, of (p 4) regulating the quantity of light admitted To allow of the movements of the iris, the transto the retina parent medium across which it is extended, and which fills the concavity of the cornea, is a fluid one, the aqueous humor hind the aqueous humor and the iris is the crystalline lens, the most solid and highly refracting of the media, imbedded in the front of the third humor, the vitreous, which itself occupies nearly four-fifths of the globe, and fills and supports the hollow of the To hold the crystalline in its place, the choroid is fixed to the outer case at the junction of the sclerotica and cornea and send inwards a circle of folds, the ciliary processes, which impress, and fasten themselves to, the vitreous humor all round the lens.

It is unnecessary that I should speak at present, even in general terms, of the mobility of the eye, of its outer protective appendages or of the source of its supply of blood. The limits to which I am confined oblige me to proceed at once to those points in the anatomy of the globe which more immediately concern our present object. And, first, of the size and shape of the eyeball

Shape of the eyeball—The human eye, when carefully separated by dissection from the muscles implanted in it, and from the surrounding fat and areolar tissue, is seen to be about spherical

in shape, with this exception—that the cornea which forms the front clear part, whereby the light has access to the interior, bulges somewhat beyond the rest, is more convex, and is the segment of a smaller sphere The sphere of the sclerotica, however, is not absolutely geometrically true in all cases, or even generally I have found it many times slightly spheroidal, with the longer axis sometimes transverse, sometimes longitudinal, and even other and more irregular departures from the exact spherical shape occur, the lateral regions occasionally presenting trivial swellings, chiefly between the muscles, and not affecting the integrity of the organ as an optical instrument Behind, where the retina is spread out, the sclerotica is thickest and stiffest, most completely retaining its proper curvature even after it has been cut into small pieces, and it is interesting to observe how carefully the exactness of its curvature in the posterior region has been provided for in the construction of the eye generally in the animal series in some instances by extraordinary thickness and density of the fibrous tissue, in others by the development of very thick or highly elastic cartilage, and even bone, in its stead

Size of the eyeball—The size of the adult human eye varies within certain limits, as might have been expected. Nevertheless, as it is a part which, by reason of its complex mechanism, and the peculiarity of some of the textures it comprises, attains its complete development, like the internal ear, before most other organs of the body have reached their adult condition, these limits are very confined, if we except instances amounting to disease. Of many measurements which I have made, the general result is that the diameter of the sclerotica is from seven-eighths of an inch to an inch

The transparent cornea forms by its anterior surface a portion of a sphere, the diameter of which is from $\frac{19}{32}$ to $\frac{21}{32}$ of an inch (that is, of usually less than two-thirds of an inch), and itoften happens that the surface of the globe recedes, or is depressed, very superficially near the line of junction of the sclerotica and cornea The cornea forms from one-sixth to one-seventh of the horizontal circumference of the whole globe

In considering the size of the eye, I should guard you against

Judging of it in any degree by the size of the aperture of the eyelids, the latter, indeed, is that which most governs the apparent size of the ball, and is also of much importance to the practical surgeon, as enabling him more or less readily to manipulate in his operations on parts within the lids. Moreover, the cornea is often apparently smaller than it really is, in consequence of the formation of a ring of opacity close to its border in the declining stages of life

Tension in health and disease — The eyeball has naturally a certain tension, arising from the due repletion of the outer case with the tissues contained within It gives a tight or resisting feel to the finger applied upon it, and the exact degree of this tension belonging to the healthy state it is essential for you to know, both that you may be aware of the resistance your instruments will encounter, and also that you may be able rightly to appreciate by the touch the departures from the healthy standard of tension which occur in the course of several diseases disorganizing processes have occurred in the interior, the eyeball frequently becomes soft, at other times hard, although, perhaps, the finger alone can inform you of these evidences of the impaired nutrition of the organ Again, in inflammations of an acute kind attacking the globe, an unnatural hardness is perceptible on pressure, usually accompanied by that dull sickening pain which attends distension of the fibrous tissues, and referrible in this case, I (p 6) suppose, in a great measure to the sclerotica and cornea The unyielding nature of these coats occasions all internal distending forces—as vascular engorgements, fibrinous or purulent effusions, if their accession has been sudden and rapid,—to react in the way of counter-pressure on the parts within, impairing their functions in the first instance, and soon irrecoverably destroying them, if allowed to continue unchecked We have analogous phenomena in the case of other organs enveloped, like the eye, in a tunic incapable of hasty dilatation

OF THE SCLEROTICA

To proceed now to a more particular account of the sclerotica and cornea And first of the sclerotica

Structure of the sclerotica —The sclerotica consists of a very

dense and intricate interlacement of white fibrous tissue surface is not glistening, like most other examples of the tissue. but dead white, by reason of the working up of its fibres in an irregular way, into a web which exhibits little indication of their In tendons, in fasciae, even in the dura mater, a silvery lustre results from the parallel course of contiguous fibres, and the small creases occurring on these confer a satiny surface, which is extremely characteristic and beautiful, but this is not the case with the sclerotica Those parts of it which are exposed to view, as the white of the eye, have no lustre of their own the brilliant reflection of light is rather from the moist surface of the investing conjunctiva, set off, it is true, by the opaque white foil of this tunic behind The fibres of the sclerotica, when unravelled from one another, and examined in minute portions under a high magnifying power, do not quite resemble those of tendon and fascia they are more straight and stiff, less wavy, less connected they also tear and break more easily, so that you cannot run them out into such long shreds as in the case of tendon or ligament Nevertheless, they swell out and become semitransparent with acetic acid or the caustic alkalies, just as ordinary white fibrous tissue You can best see the characteristic differences I have now alluded to in the posterior part of the sclerotica of the ox or sheep This much resembles the thick coat of the air-bladder of the sturgeon, which I had once an opportunity of examining in the fresh state, and it is possible that it might even be made to yield isinglass like that (p 7) There is also a good deal of delicate yellow elastic tissue intermixed with the white in the sclerotica

But although it cannot be said that the fibres of the sclerotica are arranged with regularity, yet they appear to have a more or less determinate direction from behind forwards in the hinder and middle portion, and we may also sometimes observe on the inner surface, after the choroid has been removed, an appearance of arching fibres, having their convexities turned forwards, and, moreover, the anterior part usually presents a different arrangement on its outer and inner surfaces, the fibres of the former being more circular, following somewhat the border of the cornea,

especially over the insertion of the recti muscles, while those of the latter are more obviously directed forwards

Mode of implantation of the tendons of the recti muscles — With reference to this subject, I may allude to the mode of implantation of the tendons of the recti muscles into the sclerotica These, as is well known, become flattened and expanded somewhat before joining the sclerotica, and I believe it is a common opinion that they join side to side, and spread out as a kind of external investment to the front of the sclerotica, advancing up to the cornea, and constituting the white tunic which is visible between the lids I do not find, however, that this description, as regards the human eye, agrees with nature On the contrary, the tendons of the recti appear to be truly implanted into the sclerotica, penetrating its substance, so as to be buried from view, and leaving its exterior layers exposed under the conjunc-I have several times traced the continuation of these tendons for a considerable way forwards in the middle substance of the sclerotica, to a certain extent making a division of it into an inner and outer layer, and gradually becoming lost to view, as they break up into laminae, and blend with the neighbouring structure very near the margin of the cornea

Thickness of the sclerotica at different parts —It may not seem very important in a practical point of view to inquire into the relative thickness of the sclerotica at different parts of its extent It is interesting, however, in a physiological sense, especially with reference to comparative anatomy, and is really not without its practical bearings, since we find the effects of certain morbid actions to be limited or otherwise modified in correspondence with it The sclerotica is thickest behind, for the support of the retina, and for the preservation (p 8) of its due curvature at the most material spot Around the foramen by which the optic nerve enters to join the retina, and which is near the bottom of the eye, the sclerotica is about 1-25th of an inch thick it becomes thinner forwards as far as to a quarter of an inch behind the cornea, where it is only about 1-40th of an inch thick From this line to the cornea it again increases in strength, and is from 1-30th to 1-35th of an inch thick, so as to be able to give

greater support to some of the internal parts, which I shall have to speak of in a subsequent lecture. In the monkey, and in many of the smaller mammalia, I have found this front part the thickest of all

The recti muscles being inserted as described, groove the sclerotica before entering it, and hence this membrane is rendered very thin immediately behind their insertion, hardly, in fact, being more than I-60th of an inch thick in those parts. These being, therefore, the weakest parts, are those which might be expected to yield earliest under any inward distending force, and accordingly I have observed that abscesses of the eyeball are prone to point in these situations

While upon the subject of the insertion of the recti muscles, it may be mentioned that, in cases where the contents of the globe are diminished in quantity, as a result of pre-existing inflammation of a destructive kind, and the eye consequently shrinks to a smaller size, the softness of the organ allows the recti muscles to impress it in the lines of their transit, and to bulge it in their intervals, thus pinching it, as it were, into a quadrangular shape. In such examples the thinner parts of the sclerotica under the tendons of the recti, being pressed upon by those tendons, and unsupported from within, are sunk in or flattened

OF THE CORNEA

We will now turn our attention in a more particular manner to the transparent portion of the outer case, the cornea, a part of which it would be difficult to exaggerate the importance in reference to the operative surgery, or the pathology of the eyeball, and which can hardly fail to attract your interest in a high degree, however imperfect my description of it may prove

I shall not stop to inquire what light comparative anatomy, or the (p 9) early stages of its development, might throw on the true affinities and nature of this structure, but will merely observe that there is some reason to suppose that the cornea, considered from this point of view, comprises two orders of parts—one belonging to the nervous vesicle which forms the earliest indication of the appearance of the eye in the early embryo, the

other, and the larger, pertaining to the outer integument. I prefer, on this occasion, remembering the object before us, to take the cornea as we find it in the adult human subject, and to describe it, layer by layer, as it actually exists in those in whom you will be called upon to study and relieve its morbid states

The cornea is nearly circular in shape, though we often find it wider from side to side than from above downwards. Its anterior surface is generally less extensive than its posterior, sometimes considerably so. The edge, therefore, by which it is continuous with the sclerotica will be bevelled, so that the sclerotica will overlap a little. Sometimes, on looking at the surface of a vertical section carried through these parts at their junction, we see the cornea received, as it were, into a groove of the sclerotica, but even here the hinder surface of the cornea is almost invariably the more extensive and I cannot say that I have ever seen an instance in which the bevelling was reversed, so that the cornea should overlap the sclerotica

The two surfaces of the human cornea are, as far as I can judge, perfectly parallel to one another, that is, their corresponding points are equidistant, and the substance of the cornea is of the same thickness throughout. This has been doubted by some anatomists, who have described the central part as thicker than the margins, and have supposed that the cornea was a meniscusconvergent lens, capable of magnifying objects But the mode employed to prove this—vis that of first dipping the detached cornea into water to smooth its surfaces, and then, holding it over objects, finding it act as a slight magnifier—seems open to falacy, since the only way in which it can be conveniently held is with the convex edge downwards, in which position, the water still adhering would fall to the central part, and make a lens of it But I have failed to find the membrane magnify when secured against this source of error, and, moreover, an exact vertical section of a recent cornea exhibits an uniformity of thickness When the (p 10) part has been macerated, it swells somewhat, and bulges less at the sides, where it is tied to the sclerotica, than in the rest of its extent I need not observe that the cornea, though not itself a lens, yet acts as a powerful

converger of the rays of light by virtue of the aqueous humor, which differs little from it in density, filling up its concavity in the natural state. That the cornea is not thicker in the middle is indicated by the phenomena of the disease called conical cornea, in which the weak or bulging part is always at or near the central region. In fishes the cornea is much thinner in the middle, to allow for the very projecting lens

The absolute thickness of the cornea is greater than that of the anterior region of the sclerotica, being, according to the measurements I have made, from about 1-22d to 1-32d of an inch These measurements exhibit considerable variety, which it is important for the practical surgeon to be aware of

The first portion of the cornea that comes under our review is the cornea proper, or the lamellated tissue. It is this which forms the greatest proportion of the thickness of the cornea, and gives it strength and toughness. This is bounded externally by a peculiar lamina, the anterior elastic lamina, on which rests the anterior or conjunctival epithelium, and it is bounded behind by another peculiar lamina, the posterior elastic lamina, behind which is the epithelium of the aqueous humor. It is the cornea proper alone which is strictly continuous with the sclerotical

Of the lamellated tissue of the cornea —That the cornea proper is lamellated has long been known, and may be shown in a variety of ways. If a flap be shaped out on its surface by superficial incision and then torn up, the surface of laceration will be nearly parallel to the outer surface, and in this way layer after layer may be removed, especially in the eyes of the larger domestic quadrupeds. The knife, too, especially if blunt, having once pierced this tissue, is found to pass more readily in a horizontal direction, at whatever depth. These are circumstances with which all should render themselves practically familiar, who propose to make the living eye the subject of their operations. This physical construction of the lamellated cornea makes it desirable for the surgeon, when about to penetrate the cornea, to thrust the knife somewhat perpendicularly into it, since the arrangement of the tissue tends to carry the instrument in a horizontal course.

The lamellated cornea is tough, unyielding, and almost per-

fectly transparent, (p II) and it is interesting to study the precise nature of its lamellae, because there are facts which show that its transparency is very easily impaired by any derangement of their relative position, or by an increase of their natural ten-For example, if a thin vertical section of this part be made, and laid upon a slip of glass moistened with water, it remains transparent, but if you attempt to stretch it, in whatever direction, or to compress its parts into a smaller space, it instantly becomes milky and opaque Again, if you squeeze a fresh and perfect eye between the finger and thumb, the cornea, it is well known, becomes immediately opaque in your hand, but quite recovers itself as you remit the pressure and in all cases the degree of opacity is proportionate to the pressure you exert This is a very remarkable experiment, and may serve to illustrate in some measure the opacity or haze of the cornea, which is apt to occur at an early stage of acute internal inflammation of the eyeball, attended with great engorgement of its vessels—a state also elucidated by what occurs in artificial injections of the eye, for when the vessels become gorged, and the globe tense and hard, the cornea invariably grows dim, and shuts off the iris from view

Now, that the lamellae of the lamellated cornea are not individually co-extensive with the cornea itself, is easily proved by a vertical section, in which we see the lines bounding the lamellae to be very limited and interrupted, not extending far along the cut surface, the same view proves the lamellae to run into one another at very numerous points throughout the entire cornea, so that the interspaces are very limited in their superficial extent, though their number is correspondingly great over, in tearing up a flap in the way I have already alluded to, innumerable connections between the lamellae are seen to be torn through, and the surface exposed is not smooth, but covered with numberless minute lacerations of tissue It would, therefore, be most correct to say that the strength of the tissue lies in a horizontal rather than in a vertical direction—that the horizontally-extended elements are thicker, and stronger, and less easily lacerable, than the more delicate, more fragile, verticallyplaced elements which connect them with one another Now if we endeavour to count the superposed lamellae, it is evident that we can arrive at no very exact result, in consequence of their mutual connexions and overlappings. but nevertheless it will be found in general, that on the surface of a vertical (p 12) section, somewhere about sixty intervene between any two corresponding points on the opposite surfaces of the tissue

There is a fact of some interest to be learnt from such a section, if it be made extremely thin, and it is this—that the connections between the horizontally-extended lamellae of the cornea are themselves membranous or lamelliform, and not mere fibres, for on opening out the lamellae, so as to enlarge their interspaces, very delicate membranes are seen passing from one to another, and it is but rarely that complete perforations exist, however thin the section have been made. In such specimens, viewed under a high power, we have a faintly fibrous texture apparent in even the most delicate of these films of membrane, the fibrous elements being held together in that form by an homogeneous intervening substance

The nature of the interstices of the corneal tissue does not appear to have been particularly inquired into. It has been generally considered that the interlamellar spaces are themselves flattened or lamelliform, and that they contain fluid in sufficient quantity to fall easily from one part to another, and it has been imagined that inflammatory products, lymph or pus, might gravitate in such natural spaces to the most dependent part of the cornea For the existence of fluid, stress has been justly laid on the fact, that if we lay bare the corneal tissue and make strong pressure on the globe, we shall observe first a dewy moisture, and then distinct drops of transparent fluid over the entire But this shews the porosity of the entire cornea, rather than the existence of free fluid in its interspaces, for in the perfectly fresh eye the dew does not form until the pressure has been kept up for some time, and under continued pressure the aqueous humor gradually passes out, while if this humor have been previously evacuated by puncture and replaced by air, no dew forms upon the surface Moreover, an incision into the lamellated cornea does not set free any visible fluid

It has been sometimes thought that pressure produces opacity of the cornea, by driving out fluid from its interstices, but the return of transparency is so simultaneous over the whole surface, when the pressure is remitted, as to forbid the supposition of any fluid having escaped and re-entered at the border, while the presence or absence of the aqueous humor does not affect the result at all pressure produces opacity if the chambers are filled with air. Hence it may be (p. 13) concluded that the fluid existing in the corneal tissue is only sufficient to moisten its elements, not enough to lie free in its interstices, and further, that the elementary lamellae are naturally in contact with one another, much in the same way that the filaments of the areolar tissue touch one another in other parts

Of the corneal tubes -Being desirous some years ago to discover whether the interstices of the cornea proper had any regular shape or arrangement, I made a small puncture near the border of the cornea of an ox, and, introducing the mouth of a mercurial injecting tube, was delighted to find the metal, under gentle pressure, running in a beautiful and curious manner, quite unlike anything that occurs in any other tissue, and from its constancy and peculiar figure evidently demonstrative of a natural structure The mercury coursed rapidly along in perfectly parallel and very delicate lines for a short distance, then diverged at an angle into other similar tubes, which were found to cross the former either The tubular spaces thus injected appeared to above or below be jointed or broken at varying intervals, and to present what in the nerve-tubes would be termed a varicose condition whole lamellated cornea was filled with such tubes, for at whatever depth or part the mercury was inserted, the same results followed, although, from the unnatural distension occasioned by even a small extent of such injection, it was impossible in a single specimen to fill the interstices of every portion of it, and at different depths, at one and the same time These definitelymarked passages in the corneal tissue it seemed not very easy to force or burst, but when the mercury was urged to that extent, it separated the horizontal lamellae for a greater or less space, and formed irregular flat patches, very similar in shape to those which are met with in the morbid state known as onyx, and which

latter, I therefore conclude, is attended with a breaking down of the membranous connections between the horizontal lamellae—connections (p 14) which form the side walls of the corneal tubes now described

I found that I could inject the tubes with size and vermilion quite as definitely, though not so easily, or so as to form so beautiful an object, as with mercury, but this fact was insufficient to prove that the peculiar varicosities of the tubes were not a false appearance due to the tendency which mercury has to collect itself into the globular form

What I have now mentioned is what occurred with the cornea of a large quadruped I found it far more difficult to make a similar injection of the human cornea, or of that of the cat or smaller animals, and it is not probable that interstices of equal size—perhaps hardly of the same shape and arrangement exist in the latter specimens From the greater thinness of the membrane, and the greater proximity of the entire tissue to the vascular arches from which its nutrient supply is drawn, it may be supposed that such a free and ample system of canals may be dispensed with In the human cornea, however, (as in fig 3) I have clearly seen a tubular arrangement of the interstices under favourable circumstances although, in general, the tissue too readily gives way under the distending force which it is requisite to employ The length of the canals between the constrictions does not exceed the 12th of an inch, and is for the most part much less, while their width is from 1-500th to 1-600th of an inch this is in the human cornea

It might be conceived that these corneal tubes were a modified form of lymphatic vessels, as it is generally thought that a close lymphatic net-work may be injected in a somewhat similar fashion under the skin and other parts. But I have not found the mercury escaping along the lymphatic trunks when pushed from the cornea towards the sclerotica. On the contrary, it requires hard pressure to make it escape from the cornea at all, and then it enters the anterior chamber of the eye, or the space between the sclerotica and choroid, or even subconjunctival blood-vessels (p. 15). Hence it is probable that the corneal

tubes do not communicate directly with any other set of vessels or natural channels

With regard to the use of these corneal tubes, we shall probably not be far wrong in supposing that they serve to promote and facilitate the permeation of this thick non-vascular structure by those fluid portions of the blood which alone have access to it Whether the special arrangement of the tubes which I have described is concerned in endowing the cornea with its necessary transparency, it does not seem possible to determine. It might be imagined to contribute to hold all the lamellae in place, and to prevent derangement of their relative position. A brief account of these, and other points which I shall notice, is given in the third part of the Physiological Anatomy and Physiology of Man, just published by Dr. Todd and myself

Tunction of the sclerotica and cornea —I have already stated that the lamellated tissue of the cornea is the only one which properly speaking, is continuous with the sclerotica This continuity is so perfect that the two textures cannot be torn asunder, or in any way be shewn capable of detachment along the line of junction Even maceration is not capable of effecting their separation, and if we consider the close affinities of the two structures, and their mode of union, it will be easy to understand the reason of this In fact, both belong to the class of fibrous tissues, and have very similar physical and chemical properties. The fibrous bundles of the sclerotica, intricately interlaced and intermixed with threads of yellow elastic tissue, become continuous at the border with the laminae of the cornea elementary parts of the one join on to those of the other, the interstices, which are irregular and open on all sides in the sclerotica, assume a regular arrangement, and become tubular On the surface of a very thin vertical section of the two structures, carried through their line of junction, the transition of one into the other can be very satisfactorily traced By acetic acid the sclerotica swells and becomes transparent, and exhibits the yellow fibrous element of its structure, and also sparing nuclei, like those belonging to tendinous parts same agent, the cornea first grows opaque as the arrangement of

its parts is interfered with by the swelling of the tissue during the progress of the acid through it, but subsequently it all very nearly resumes its transparency, (p 16) merely displaying here and on the surface of its lamellae the elongated nuclei which were previously indistinctly seen, and which correspond closely with those of the sclerotica and other fibrous tissues

The description of the lamellated cornea will be most conveniently concluded in connexion with that of the anterior elastic lamina, to which I shall, therefore, now direct your attention

The anterior elastic lamina has not hitherto, as far as I know, been distinguished by anatomists, and yet it seems a structure of a very interesting kind, an acquaintance with which will perhaps enable us to discriminate some morbid phenomena from others with which they have been classed It is a continuous sheet of homogeneous membrane, nearly similar in essential characters to the posterior elastic lamina of the cornea and the capsule of the lens, being perfectly transparent and glassy, without appearance of internal structure, and being very slightly or not at all influenced by acids Its thickness in the human eye is from about 1-1200th to 1-2000th of an inch, and it forms an unbroken covering to the whole laminated cornea, giving it that smooth glistening surface which is exposed by scraping off the conjunctival epithelium This latter rests upon it as the epithelium does upon the basement membrane in other situations, and I may observe that it appears to me to be strictly a highly-developed form of the basement membrane of the mucous system, remarkably modified in this particular part to answer a special purpose.

The manner in which the anterior elastic lamina is united to the lamellae which it serves to cover, is very interesting. It must be borne in mind that the anterior surface of the cornea is convex, and that the maintenance of its exact curvature is of primary importance to vision, as it is there that the first inflexion of the rays of light falling on the eye takes place, and further, that the conjunctival epithelium being a soft and fragile substance, must take the figure of the surface on which it rests. hence, probably, the arrangement I am about to mention. The

anterior elastic lamina, a firm resisting, uniform layer, placed in front of the more soft and porous lamellated tissue, is tied down to the anterior lamellae, at innumerable points, by filaments of similar texture to itself, which it sends in among them. These, as they penetrate the lamellae, divide and expand in such a (p. 17) manner as to take firm hold of them, and are thus gradually spent among the four or five lamellae which lie nearest to the surface. It is singular, too, that these filaments are not set vertically, but everywhere in a slanting direction among the lamellae, so that in a vertical section they appear to cross one another at right angles. This arrangement might, I imagine, be shown, on mechanical principles, to be the best possible for the maintenance of the convexity of the front of the cornea.

It is obvious, from the elaborate manner in which the anterior elastic lamina is thus tied down to the lamellated texture, that it can hardly be raised as a separate layer, and hence, probably, the reason of its having been hitherto overlooked. In fact, it scarcely admits of being demonstrated, except on the face of a section of the cornea

The anterior elastic lamina becomes exceedingly thin, and disappears, at the margin of the cornea, its attenuation being accompanied by an increase in the number and size of the filaments which it sends down to the lamellated tissue, so that it seems to expend itself by giving origin to these filaments from this extreme border, where it ceases to be distinguishable, a great abundance of them runs into the sclerotica, in that slanting course which the elastic lamina would have itself taken, if it had been prolonged in the direction of its own curvature filaments mingle with the elements of the sclerotica, and are gradually lost among its middle fibres The artificial mode in which the margin of the anterior elastic lamina is thus fixed, may be roughly likened to that of the awning of a tent it is rendered much more obvious if a thin vertical section of the parts at the junction of the sclerotica and cornea be treated with acetic acid

(p 18) That this lamina, although apparently homogeneous, like a sheet of glass, is very permeable to fluids, as is the capsule

of the lens, may be readily shewn by squeezing an eye after the conjunctival epithelium has been scraped off the small drops which collect on the surface rest upon this lamina after having transuded through it

The existence of this lamina will help, I think, to explain, what must have often puzzled surgeons, viz the tenacity with which small particles of steel, or other sharp angular fragments, stick in the front of the cornea only just within the surface These will often remain for many days, or even weeks, and prove the cause of much inflammation, and yet still be found difficult of extraction, which could hardly be the case if the lamellated tissue and the conjunctival epithelium were the only textures in which said particles could be imbedded

The conjunctival epithelium of the cornea may be now conveniently adverted to it is that delicate, soft, almost pulpy layer, which forms the anterior surface of the cornea, and is so easily raised by the knife or needle. It is a continuation of the epithelium of the conjunctiva covering the front of the sclerotica and lining the lids, and consequently of the cuticular investment of the body

In those animals which lose and renew the cuticle, by a constant process, unmarked by periods of intermission, the superficial particles are gradually shed after arriving at their mature state, while others are as gradually originated in the deepest region, on the tissue which serves as a basis of support, and near which lies the source of their nutriment. This is precisely what occurs on the outer surface of the cornea in the human eye. The epithelial particles are exceedingly transparent, but in position, form, and mode of growth and decay, they bear a close resemblance to the epidermis. In different animals the number of epithelial layers varies according to the size of the eye. In man, they constitute only a triple or quadruple series, altogether not exceeding the 1–500th of an inch in thickness. The deepest, which rest on the anterior elastic lamina as on a basement membrane, are slightly elongated vertically, and stand endwise, the next are angular or subglobular in shape, and the most superficial are flattened scales, more or less overlapping one another, and of a

darker hue than the others when seen by transmitted light The imbricated scales of the surface have their minute inequalities filled up in the natural state by the watery secretion of the lacrymal gland, so as to present a (p 19) nearly smooth refracting surface to the impinging rays of light, and by the frequent movements of the eyelids, the particles which are decaying and losing their place are brushed away, and escape by the nose. In a learned and interesting paper by Dr. Mackenzie, you will find described a method of seeing in your own person the nature of the corneal surface. This epithelium is rapidly renewed, if scraped off 4

We may now, gentlemen, turn our attention to the posterior elastic lamina of the cornea, a layer which has been long known as the membrane of Demours or of Decemet, or as the elastic lamina of the cornea, or as the corneal part of the membrane of the squeous humor

This layer is very easily detached by scraping from the hinder surface of the lamellated tissue of the cornea, for it adheres but slightly to this tissue, and sends no filaments among the lamellae, as the anterior elastic lamina does. It is a uniform, transparent, homogeneous layer, considerably thinner than the anterior elastic lamina (being only from 1–2000th to 1–3000th inch thick), but, like it, not affected by maceration, by boiling, or by the action of acids. Though very hard, and capable of resisting much pressure, and giving a crisp sound when divided by the scissors, yet it is very brittle and easily torn, and its fragments then show a remarkable tendency to curl up on all sides into rolls, and always with the anterior or naturally convex and attached surface inwards in the roll, so that it would appear to be formed or laid down in situ in a curve precisely the reverse of that which its elasticity inclines it to assume

³ On the Vision of Objects on and in the Eye Edinb Medical and Surgical Journal, No 164

⁴ Viz in about three days The instantaneousness with which the blood-vessels of the neighbouring conjunctiva, and even of the whole eye, dilate and become turgid with blood, when this epithelium is abraded, has often excited my astonishment. The share of the nervous system in this phenomenon is partly indicated by the severe and apparently inordinate pain which attends so slight an injury.

When an ulcer has destroyed the lamellated tissue, it sometimes happens that, for a short time, the posterior elastic lamina is thrown forwards into the breach, by the aqueous humour behind it, and forms there a small pellucid vesicle, which, however, almost always soon gives way by rupture, allowing the humor to escape, and the iris to fall forwards against the opening This morbid state illustrates very well the properties of the layer now under consideration ⁵

With regard to the behaviour of this posterior lamina at the margin of the cornea, much difference of opinion—I might say, much uncertainty—prevails, some holding that it is reflected in a modified form over the whole of the anterior and posterior chambers of the eye, others believing it to terminate with the cornea, but none, as far as I am aware, having given a full and accurate account of its actual condition, which is one of considerable importance to a correct knowledge of the physiology of the organ, and to the understanding of some of its diseases

Marginal plexiform tissue of this lamina—This layer, then, will be found to terminate at the border of the cornea in the form of plexiform fibres of the yellow elastic kind, or that variety which is allied to itself in essential characters. In this respect it resembles the anterior elastic lamina. The plexiform fibres spring only from its anterior surface, or that towards the lamellated cornea. They begin to appear a very short distance from its edge, and, as they arise, the lamina itself becomes thinner,

⁵ In a case recently under my care, the posterior elastic lamina saved the ulcer from perforating Mr James M —, aet 52, had at the end of June a central ulcer, which was touched with lunar caustic, and he took quinine By the middle of July it had gradually penetrated to the deepest layers of the cornea, and the posterior elastic lamina was laid bare, and bulged slightly into it from below, especially when trifling pressure was made upon the globe for the sake of testing the condition. Under a continuance of the tonic treatment this ulcer gradually filled up, the aqueous humor not having escaped, and I saw him in February following with an opacity on a level with the rest of the cornea, but with its central portion (answering to the previously exposed posterior elastic lamina) of a denser white than the border

When this lamina is thus exposed at the bottom of an opaque milky ulcer, centrally placed, the dark pupil may become visible through it, and look like a particle of dirt, deceiving the surgeon into an attempt to remove it, in making which he inevitably opens the anterior chamber.

and is at last altogether spent. They all pass irregularly outwards, occupying, of course, a position between the posterior elastic lamina and the lamellated cornea, and are finally reinforced by those fibres which come from the thin and extreme edge of the lamina. Immediately beyond this edge, therefore, at the rim of the anterior chamber, there is a layer of open plexiform fibres, passing outward, or from the axis of the eye, and (p 21) being the continuation or representative of the posterior elastic lamina. The posterior of these fibres then curve backwards to the iris, and become inserted into its anterior surface at its greater circumference, in the form of small pillars, and near their insertion they begin to resemble the white fibrous rather than the yellow fibrous tissue in chemical and other qualities

I have found these pillars of the iris much more evident in some animals than in others, but time will not allow me to enter on comparative details. They exist in all mammalia, and have their analogues in other classes. They are in contact with the aqueous humor, where they form the rim of the anterior chamber. A needle may be passed underneath them from the anterior chamber, so as to suspend by them a considerable fragment of the eyeball

The great portion, however, of the fibrous continuation of the posterior elastic lamina goes not to the iris, but to the ciliary circle,—a name by which anatomists refer to a flattish circle of gray semitransparent tissue, which intervenes between the ciliary processes of the choroid and the sclerotica, immediately behind its junction with the cornea, about which extraordinary differences of opinion prevail, but which I shall hope to show you, in a subsequent lecture, is muscular. For convenience, therefore, I will now assume that it is such, and term it the ciliary muscle. This muscle arises, then, from the fibrous tissue coming from the posterior elastic lamina,—the fibrous tissue passing in a sheet backwards to the anterior region of the ciliary processes, and giving origin on its outer surface, or that turned from the anterior chamber, to the fibres of the ciliary muscle, which then clothe the outer surface of the choroid for about one-eighth or one-tenth of an inch, as far as opposite to the ora serrata

There are still other fibres derived from the posterior elastic lamina—viz. those placed most anteriorly, and which were the first to take origin from it. These, after a short course outwards, become separated from the sclerotica by a narrow space all round, known as the sinus circularis iridis, and which has been considered as a venous canal, afterwards they pass to be united firmly to the sclerotica beyond this sinus, and in so doing share principally in its formation. But there also exists here a series of circular fibres, those just described being more or less radiating. the circular lie outside the others, are opaque, white, and stiff, contributing to the formation of the circular sinus, and to that firm union, the ciliary ligament, (p. 22) which subsists between the ciliary processes and the anterior rim of the sclerotica; and which, as a whole, effectually serves to prevent the aqueous humor from escaping into the space between the sclerotica and choroid.

I am aware of the difficulty I must experience in attempting to give you a clear description of this structure, before I have passed in review those others with which it is associated What I have now said, however, must suffice for the present, and I shall return to it in connection with the iris and choroid and lens A few words remain concerning the posterior epithelium of the cornea, or the epithelium of the aqueous humor.

This is so extremely delicate and so perishable a layer, that it has only of late years been recognised, and yet it is very easily prepared for examination. It is a single series of flat epithelial nucleated particles, placed side by side, and united by their margins. Even in large animals the epithelial cells are not in a double layer. It is co-extensive with the posterior elastic lamina, which it separates from the aqueous humor. It would appear, however, from what has just been said concerning the conversion of the posterior elastic lamina at its border into fibrous tissue, which in part passes through the aqueous humor to the iris, that this epithelium must cease with the elastic lamina, since there is no longer any stratum on which it can rest. I have not been able to discover the smallest appearance of it upon the pillars of the iris, and I conceive, therefore, that it is limited to the cornea

I have called this the epithelium of the aqueous humor, because it is the only true epithelium which can be found in contact with that fluid. I shall have to show in a future lecture that the front of the iris has no true epithelial investment, and that the front of the lens is also destitute of such a covering. It seems, therefore, incorrect to speak of the chambers of the eye as lined by a serous membrane, or of the aqueous humor as contained within a proper capsule; and I suppose that practitioners must abandon the name, at least, of that affection, which is now generally termed aquocapsulitis, even if they continue to regard it as a distinct disease.

In my next lecture I shall proceed to notice some of the morbid states of the sclerotica and cornea; and shall endeavour to connect my remarks as far as I can with the anatomical, and, I fear, rather dry details, which I have had to dwell upon today.

Lecture II

Blood-Vessels and Nerves of the Sclerotica and Cornea—Character of the Nutritive Process in These Structures—Morbid States of the Sclerotica and Cornea—Sloughing of Both Corneae from Defective Nutrition—Reparative Process in the Cornea—Anatomy of a Simple Ulcer of the Cornea—Formation of Vessels in the Cornea—Effect of General Disease on the Cornea.—Lymph or Pus in the Lamellated Tissue—Pustules.—Opacities of the Cornea—Development of Papillae on the Cornea—Anatomy of Staphyloma Corneae.

Gentlemen,—In my last lecture I reviewed the structure of the outer tunic of the eyeball, consisting of the sclerotica and cornea, and described the several layers of which the latter is composed It remains for me, before proceeding to the more internal parts, to make some observations on the nature of the process of nutrition, as it obtains in these structures, and on the bearing of their anatomical construction on the nature and progress of some of their more important diseases

Both the sclerotica and the cornea are sparingly supplied with

the materials of nutrition, as a glance at the arrangement of the blood-vessels will show The sclerotica is obliquely pierced behind with numerous arteries derived from the ophthalmic, termed the posterior ciliary, but these go almost exclusively to the choroid, only giving a few minute twigs to the sclerotica as they pass In front, too, the arteries which have supplied the muscles of the eyeball send forwards beyond the tendons small prolongations, which are visible under the conjunctiva, and lose themselves in the sclerotica, within an eighth of an inch from the margin of the cornea These, however, traverse rather than supply the sclerotica, and anastomose with vessels of the ciliary muscle and iris Hence, in the most successful injections, the sclerotica itself is with difficulty tinted by the artificial colour, and the (p 24) microscopic inspection of parts so prepared exhibits only a few slender capillaries coursing among the greatly preponderating mass of the white fibrous tissue. And if we pass from the sclerotica to the cornea, we shall find the most unequivocal proof that no blood-vessels at all encroach far beyond its border The evidence which injections are capable of affording on this head is very decisive. We now know that the capillaries are, in almost every organ, definite and determinate tissues, having proper walls, which may be distinguished from the parts among which they lie, that they have a certain limit as regards minuteness, and that they form everywhere a closed system of tubes, porous, indeed, so as to be capable of transmitting fluid materials, both inwards and outwards, by a process of imbibition, but nevertheless having walls of unbroken membrane, without breach or orifice Hence if an injected specimen exhibits a system of such canals, replete with artificial coloured contents—its ramifications regular, having margins formed by rounded, arched, entire capillaries—we may safely assert that the vascular net-work really terminates naturally at those margins, and that the tissue beyond has been as impermeable to the red particles of the circulating blood, as we find it to be to our prepared fluids This is precisely what occurs in the case of the cornea. The vessels of the sclerotica, and of the conjunctiva covering the sclerotica, send numerous twigs towards the cornea,

but all, on arriving within the corneal tissue, turn back, forming numerous arches, which run parallel to the margin of the cornea for some way, and then return from whence they came Thus we have a striking difference between the sclerotica and cornea in addition to those before insisted on,—that the one is permeated by blood-vessels, the other is entirely devoid of them

I may say a few words here on the nervous supply of the two No doubt the nerves of both are few, the sclerotica gives passage to the ciliary nerves, and although they have not been demonstrated, it is possible that it receives some filaments from them. In a state of health it seems to be very insensible, but when inflamed, like many other dull and almost insensible parts, it appears to be capable of becoming the seat of very acute In the cornea, nerves derived from the ciliary are said to have been discovered by more than one anatomist of trust I cannot say that I have myself seen them, although I cannot doubt their existence, for when we remember that nerves in their peripheral distribution may lose their (p. 25) tubular nature and their characteristic microscopic appearance thence derived, (and I have constantly found the ciliary nerves do this) we may well be content to receive pain as sufficient evidence that a part is not destitute of nerves. That the cornea has a degree of sensibility capable under some forms of irritation of being exalted to a considerable height, is matter of common experience

From what has been said, it may be safely concluded that the sclerotica and cornea are slowly renewed in their elementary constitution by the process of nutrition. No doubt the presence in or near them of the materials of change is absolutely necessary for the continuance of their life, but what I would endeavour to impress upon your minds is this,—that their structure is feebly supplied with blood, or the nutrient part of that fluid—that the process of nutrition in them is therefore slow, inactive, and easily impaired, either by impoverishment of the nutrient material or by any mechanical interference with its due and regular supply. These observations apply more to the cornea than to the sclerotica, because the latter has vessels, the former has none, the latter, therefore, is supplied interstitially, as it were, with

the power of life, growth, and nutrition; the latter must derive through the medium of its circumferential parts whatever is requisite to sustain the integrity of its more central portions

Morbid states of the sclerotica —I shall have but few observations to make, gentlemen, on the morbid states of the sclerotica, in their special relation to its structure: wounds of this part readily heal by the adhesive process, the cicatrix being semitransparent as in tendon, and minute punctures are generally harmless, even when they penetrate not only this coat, but the It is possible that the readiness with which lacerations and incisions of the sclerotica heal, is ascribable to the thinness of the tissue, and to the fact that it has on both its surfaces an abundant supply of blood in the contiguous textures perience which surgeons have acquired in their operations on cataractous eyes, affords ample proof of the slight tendency which simple wounds of the sclerotica have to take on an unhealthy action. The form of inflammation which the sclerotica usually undergoes is the rheumatic. Into the nature and symptoms of this it would be out of place to enter, as we must limit ourselves at present to the anatomical condition.

In inflammation of the sclerotica, when least complicated with conjunctival disease, its vessels are seen to be unnaturally filled with (p 26) blood, its capillaries are distended, so as to become visible by imparting a tint to the fibrous tissue, and the minute arteries and veins enlarge and become tortuous. All these are distinguished by their purplish hue, compared with the more superficial vessels of the conjunctiva under inflammation.

In some delicate persons the sclerotica is so thin in its anterior part as to derive a bluish tint from the choroid underneath. This is no disease, but in cases of old-standing choroidal or other disease within the globe, which has operated so as to cause a slow and gradual distinsion of the outer coat, the pigment is in like manner disclosed under the bulging and attenuated sclerotica; and I have observed in some cases that under this internal stretching force the sclerotica is apt to yield in lines passing backwards from the cornea, so as to form slits or chinks more or less radiating, through which the choroid is more obviously seen. This depends

on the disposition of the fibres of the sclerotica, which I alluded to in the last lecture, viz their passing at the anterior region rather in a radiating direction from the cornea than in any other arrangement

Morbid states of the cornea —To the surgeon, as to the anatomist, the cornea is a much more interesting and important texture than the sclerotica, and I therefore propose to be a little less brief in commenting on some of its principal morbid states, especially such as either illustrate, or are illustrated by its structure, as explained in the former lecture.

And first, gentlemen, in evidence of the comparative feebleness of the process of nutrition in this texture, I shall relate the following case which occurred at this hospital during the present spring

Sloughing of both corneae from defective nutrition -On the 8th March, a mother, herself reduced in strength and looking ill, brought her infant, 13 months old, to the hospital, on account of its eyes. I found that both corneae were in a state of slough, flaccid, of a pale yellow, like macerated leather, that this slough comprised the whole area, except a very narrow belt of about 1-20th of an inch nearest to the sclerotica, from which latter a few minute vessels were shooting towards the line of separation, which was already beginning to be established between the dead and living parts The conjunctiva exhibited very little vascularity, and had evidently not been suffering from inflammation. The infant was pallid and puny, with (p. 27) a pinched and anxious countenance I found that the mother had been suckling the child till seven weeks from the time I speak of, being herself ill and weak, and very insufficiently nourished, that on going into the workhouse they had been parted, and that she first noticed the eyes to look "weak" three weeks since The bowels had been constantly purged for eight days, and she had been taking rhubarb and magnesia. The compound powder of chalk, with opium, was given every four hours, with the Liq Cinch Battley, and beef-tea, with small quantities of brandy, and Mr Heward kindly undertook to visit her at her own home the 11th (three days afterwards), I found more vascularity at the margin of the corneae, and over the white of the eye, but with

hardly any secretion. The bowels had been less relaxed, but the stools were still green and loose She had taken some wine and bark, but would not touch the beef-tea She was evidently weaker, and mouned constantly In two days afterwards she died

In this instance we find the cornea falling into a state of gangrene from defective nutrition, the impoverishment of the blood, manifested in various degrees in the other textures of the body, here leading to the complete destruction of a tissue which naturally has a very small supply of that necessary fluid, and which therefore is but too ready to yield its vitality when that supply is withheld. The case of this poor child finds a parallel in others which have been related, as occurring from actual starvation, or the privation of all sustenance, and perhaps still more aptly in those animals which Magendie confined to a diet of sugar and water, or other non-azotised food, and of which one of the more constant evidences of declining power was the sloughing of the corneae, and the consequent destruction of the eyeballs ⁶

I may also mention the case of a woman who is now in attendance here, and who, on her first appearance some months ago, had a dull, hazy state of both corneae, the surface having lost its brilliancy, and the whole texture being very uniformly obscured The approach of this condition had been very gradual It had been attended with no redness, nor was there, at that time, any excitement of the circulation in the neighbouring sclerotica or conjunctiva, or any development of new vessels in the cornea itself She was pallid, but her muscular strength was not remarkably reduced, nor could I discover that she had been insufficiently fed in regard either to quantity or quality, or (p 28) that she had any disease affecting a vital organ. Nevertheless, her pulse and countenance bespoke a system in which the powers of life, from some cause or other, were considerably depressed, and Mr Dixon concurred with me in recommending a strictly tonic course of treatment, comprising steel and quinine, with such modifications in diet, place of abode, and mode of life, as her situation appeared to render desirable. Under this plan,

⁶ The corneae may fall into slough in an analogous way after scarlatina

which has been continued up to the present time, a steady improvement has taken place in the condition of the corneae. The haze is clearing away in the most gradual manner, and without any unnatural vascularity of the part or neighbourhood, and her looks are much improved in every respect. I cannot help regarding this affection as simply the result of an impairment of the nutritive process in the whole body, showing itself in a special manner in this texture of feeble power.

Reparative process in the cornea —The cornea when healthy is readily repaired after injury, punctures and incisions being followed in general by speedy reunion of the divided parts, without suppuration or sloughing The adhesive process is here presented to us in its simplest form, for it takes place in a structure which contains no blood-vessels, and therefore where none have been divided But if we bear in mind that all tissues have a proper life of their own, of which their several properties and actions are the necessary manifestations, and that the bloodvessels are but ministerial to the proper life of the tissues they supply, by serving as the medium through which the materials essential to life are brought within their reach, and what is rejected by them is carried away, we shall readily understand how it is that a tissue which, like the cornea, originally grew, and has its ordinary life sustained without the presence of interstitial vessels, may be also repaired and renewed without them within certain limits. For the reparative actions, in their natural form, are nothing more than those of growth and nutrition, modified by the new conditions occasioned by external accident, and tending constantly to a removal of those new conditions, and the restoration of the normal state

If we puncture or incise the cornea, the first effect is a change wrought in the natural actions of nutrition then existing in the (p 29) wounded part,—a change which can only be described as a mechanical interruption to those actions, and which, from

⁷ This patient, at the end of three months, had recovered the transparency of the corneae, and was much improved in health. She has, however, on two subsequent occasions, had relapses, from the last of which she is now recovering, but with the right cornea considerably, and I fear permanently, clouded

the resultant train of phenomena, has been often called a stimu-This is speedily followed by the presence of an increased quantity of blood in the vessels that are nearest to the wounded part—viz in those of the conjunctiva and those of the sclerotica, and thus the materials from which the breach is to be made good are brought in greater abundance to the part that requires them We cannot doubt that as these vessels, comparatively so remote, are thus affected, so the part of the corneal tissue intervening between them, and the exact seat of injury, is pervaded by a corresponding change, of which the general expression is this,—that it is one of exalted nutritive vigour, the play of forces, and the interchange of material, which mark the nutritive function, being more energetic and more rapid than before And whatever phenomena of this kind occur in the intermediate tissue are concentrated in an especial manner about the wound itself a short time, even in the course of a few hours, as I have ascertained in the case of the lower animals, the vicinity of the injured part begins to contain in abundance those minute particles, nuclei, or cytoblasts, as they are called, which exist naturally, though sparingly, in the corneal lamellae, and the relative quantity of which may be regarded in most tissues as an index of the intensity of the nutritive function These particles, I say, hastily, indeed, and imperfectly formed, are speedily found choking the interstices of the tissues in the lips of the wound, and covering its surface, so as to occupy whatever space was left between its opposite sides, and bringing them into temporary From the presence of these embryo materials of new tissue, intermingled among the elements of the old, is derived that slight milky opacity which envelopes and marks the seat of wound, and which, if the injury be extensive, may engage a considerable extent of the cornea in the direction of the neighbouring blood-vessels The subsequent changes I need not particularly dwell upon The breach being filled, the new material is gradually transformed into products resembling those tissues among which it has been poured, the blood-vessels, at the border of the cornea, resume their size, and at length, in the most favourable instances, all vestige of the wonderful process which has taken place vanishes away.

Such is the progress of the actions which usually ensue when the surgeon punctures the cornea with his needle for the purpose of (p 30) operating on a cataract, and the same takes place, in general, whenever there is no destruction of substance, where the wound is not too large, and where its margins have been accurately adapted. But it will readily be conceived that, in cases of wounds with loss of substance, or attended with extensive division of parts, the demands on a tissue so feebly nourished must exceed its limited powers. The result will then oftentimes be the failure of the adhesive process, with the establishment of a temporary ulcer or open breach, or with an actual sloughing of the lips of the wound. The reparative actions then advance more slowly, and in a modified form, by a species of granulation very similar to that which obtains in corresponding states of the skin or mucous membrane.

I had an opportunity last year of examining a small ulcer which had been occasioned on the centre of the cornea of a cat, by the contact of a small piece of caustic potass, three days previously The conjunctival epithelium and the anterior elastic lamina had been removed, and the superficial lamellae of the cornea proper formed the bed of the ulcer These were softened and semi-opaque, from the presence of great numbers of the nuclei already alluded to, in and around, and it was interesting to observe that their numbers were greatest on the surface of the ulcer, and diminished in proportion to their distance from it In the section of the ulcer, represented in fig 5, the nuclei are seen occupying chiefly the position of the corneal tubes, especially in the deeper part (compare this with d, fig 4) We have, in this example perhaps the simplest condition of an ulcer that can occur in any texture, and it is therefore well deserving your attention

Development of vessels in the cornea—Few things are more interesting in the (p 31) history of reparative processes in the cornea, than the fact which we observe every day, of its capacity of becoming furnished with blood-vessels derived from those of the conjunctiva and sclerotica. If any irritation is long kept up, or if any ulcer exists having to heal by a slow and gradual process, we usually find in the interval between it and the neigh-

bouring vessels, a greyish, half-transparent tract, distinguishable from the healthy cornea, and in this there are soon developed a series of vessels which presently declare themselves as arteries, capillaries, and veins, carrying the blood in a circuit through and about the seat of reparative action 8 It is obvious that these are produced out of new matter, laid down before their actual formation in the line which they are to occupy. As a punctured wound is made good by the simple transformation of the new matter into the natural tissue, without the formation of new vessels, so, when time allows, and the extent of repair requires it, a portion of the new material is developed into vessels, which may serve the temporary purpose of expediting and fortifying the reparative actions, by bringing to them an immediate and interstitial supply of blood Thus is the cornea made dull and useless for a time, by the introduction of a structure destructive of its transparency, in order that its integrity may be restored according to the natural laws of growth When its restoration is somewhat advanced, and less blood is required, these new vessels dwindle, their coats, which are at best imperfectly organized, soon disappear, and the cornea becomes once more permeable to light I have a specimen in which these adventitious vessels are displayed injected with artificial colour They pass into the cornea from the conjunctiva, and from the whole thickness of the sclerotica, and occupy, in this particular instance, almost the whole thickness of the lamellated tissue

The cornea may further become vascular without ulcer or wound, and simply as a result of continued inflammatory action, and this in two principal ways: either the new vessels may form a network on the front of the cornea, anastomosing on all sides with those of the conjunctiva, and only obscuring the lustre of its surface, or they may pass in very close and more parallel series from the sclerotica, so as to (p 32) make the cornea uniformly of a dull red The former state is the result of long-continued irritation of the conjunctival epithelium by granular lids or displaced lashes, and the vessels in all probability lie

⁸ This does not always happen, for some chronic ulcers of the cornea will heal in the most gradual manner without the formation of any vessels in their vicinity

immediately beneath the anterior elastic lamina, in the more superficial lamellae of the cornea proper, but I have never had an opportunity of actually ascertaining this. They can hardly lie over this lamina, and it is too thin to contain them in its substance. The latter condition results from chronic inflammation of the lamellated tissue, and is attended with an opaque deposition of new matter. The vessels run in among the lamellae, and may occupy the entire thickness of the cornea proper, rendering it nearly impervious to light

In both the forms of morbid vascularity now mentioned, the vessels are to be regarded as originally a result of diseased action, not as themselves the disease. They are developed under the salutary or conservative law of the organism, to enable a part of feeble vitality to sustain a morbid action to which it has become subject, and under which its vitality would otherwise sink. It is true that their presence marks the existence of disease, and is to a certain degree an index of its extent, but we must be on our guard against imagining that it constitutes its essence. Unless these vessels had been developed, the diseased process would long ago have terminated by the total destruction of the tissue. If, in the case of the impoverished infant which I related just how, there had been sufficient vigour in the nutritive and organising process to fill the corneal tissue with offshoots from the surrounding vessels, the eyes might not have perished

The cornea, and other parts of low vitality, or of such a texture as cannot speedily develope new vessels, often fall into gangrene under any sudden inflammation, because their vascular supply is either very limited, or cannot expand in correspondence with the demands of the morbid action. On the other hand, practical surgeons know that it is very difficult to induce destructive inflammation in erectile tumors, which are distinguished by the abundance of their vascular supply

We may even go further, and maintain that these adventitious vessels are necessary to a cure, and to their own removal, which may seem a paradox, but is nevertheless a very sustainable proposition. For as the morbid products (including the vessels) laid down in the cornea, require for their existence a certain

accession of new material, (p. 33) in the way of continuous nutrition, so they cannot be removed unless means are found for the absorption and removal of the old material of which they are composed, and these means are mainly the vascular channels. As long as the material capable of being removed remains, the vessels remain also, though gradually atrophied, and ready to disappear, and sometimes, when the morbid products have been so long laid down as to have become organized into permanent forms of morbid and opaque tissue, the vessels, in reduced number, are found to remain also, as being necessary for the existence of that which cannot now be taken away by any interstitial process of absorption, and which must therefore be either nourished or die

The presence of these vessels in parts of the cornea that have been once inflamed, is often made evident by their sudden engorgement with blood, under any casual irritation, such as exposure to a strong light, or the puncture made by the surgeon's needle

The unity which reigns throughout an organised body of so much complexity as our own, renders every part liable to be influenced by the state of the great organs subservient to nutrition, the digestive which proved, the respiratory which renovate, the circulating which distribute, and the excretory which purify the blood. The nutrition of every organ or tissue is subject to derangement, when the blood from which it derives its materials of renewal is impoverished or altered in quality, or when that healthy balance of the circulation is lost, to which Dr Farre called your attention a short time age

It is not to be thought, therefore, that the morbid phenomena of any of the textures of the eye, or of the body at large, can be rightly comprehended by one who never has regard to the condition of what is termed "the general health," and, least of all, those of a texture like the cornea, which, being itself bloodless, and deriving its supply of nutriment by a frail tenure from surrounding parts, must necessarily be obnoxious in a peculiar degree to certain of those disturbances which another more favoured part might have sufficient vigour of life to disregard or

overcome It would be very easy to enlarge on so fertile a theme, but I must dismiss it with this simple allusion, or it would lead us too far from the proper subject of these lectures—It is perhaps of even greater importance still that these views should influence our minds in considering the propriety of an operation for cataract in any particular case, and especially of that of extraction, which involves an extensive division of the corneal tissue, and to the (p 34) success of which, reparation of the wound by the first intention so much contributes

Lymph or pus in the lamellated tissue -As a result of inflammation of the lamellated tissue, lymph or pus may be formed in the interstices of the lamellae, attended, in the first instance, with irregular haze, and then with mottled or patchy opacity, as it accumulates in greater abundance in certain situations the inflammation be of an acute kind, and the effusion rapid, so as to gorge and distend and press upon the lamellae too much before their supply of blood can be suitably augmented by newlyorganised vessels, and especially if the system be at the same time in an enfeebled state from defective nourishment, or the scrofulous diathesis,—the lamellae become irregularly separated from one another, their tissue is broken up and destroyed, and a slough results which is usually of a flattish form, often engaging a considerable area of the cornea, but not its entire thickness, 1 e following the direction of the lamellae, or a simple abscess may form, which may discharge itself either backwards into the aqueous chambers, or on the external surface of the cornea In either case it very commonly happens that the remaining part of the thickness of the cornea gives way, making a complete perforation, through which the aqueous humour excapes, and the The injury done to the eye by such extensive iris prolapses disease is severe and permanent, a portion of the cornea has its place supplied by new matter, which becomes developed into an opaque tissue very different in constitution and elementary arrangement from that which has been removed, and the pupil is more or less distorted or dragged away from the axis of vision

If, however, the inflammation of the lamellated tissue be less acute, and less disposed to run rapidly to destructive results,

the lymph which is poured out collects in small portions among the lamellae, giving an irregularly mottled aspect to the cornea, because some parts retain more of their transparency then the rest, though all are dim, and vessels are gradually formed in the corneal tissue, entering it at various depths from the neighbouring sclerotica. When this occurs, the sclerotica itself, for a short distance from the cornea, appears of a dull red, owing to the augmented quantity of blood passing through its vessels to supply this new demand. If the disposition to the formation of lymph in the corneal tissue continues, the enlargement of its vascular supply tends to accelerate the subsequent (p. 35) changes, the whole tissue gets interfused with opaque matter and additional vessels, and the original lamellated structure becomes thickened, softened, and obscured

After so delicate and important a part has been apparently spoiled by a serious disease, it is not a little interesting to notice how completely and how speedily, in many instances, its perfect transparency may be restored by timely and judicious treatment. For in such cases you will observe that the original tissue of the cornea is not in any measure destroyed, or its arrangement permanently altered, unless the duration of the morbid state has been considerable, and time has been thus afforded for the organization of permanent forms of unnatural tissue in its interstices

Moreover, when once the inflammatory action and the inclination to the formation of morbid products have been subdued, the blood-vessels which pervade the deteriorated structure begin to assist largely in its restoration, by expediting the absorption and removal of the newly-deposited lymph, and in porportion as this clearance is effected the vessels themselves diminish in size, and finally disappear. The speed and completeness with which the cornea resumes its previous state will depend much on the promptness with which the treatment is undertaken, and the energy of the nutritive function in the part and in the whole body. In scrofulous subjects, who are especially prone to this affection, it is notorious that there exists in the constitution a grave and deep-seated defect, which manifests itself chiefly in

imperfect or perverted nutrition, and until this is in some degree corrected, this disease can hardly be checked, or its consequences got rid of

The cornea evinces its near alliance with the integumental tissues, by its disposition to the formation of small pimples, or phlyctenulae, on its anterior surface. These, too, are most common in young strumous subjects, they are generally situated at or near the margin, and appear on the conjunctiva at the same time. They are slow in their progress, and ere they have reached their full size are generally provided with a leash of conjunctival vessels, which give a characteristic appearance to the eye. They are formed on the front of the cornea, and, I should suppose, immediately under the anterior elastic lamina, and the vessels they acquire also, of course, he under that lamina, and come from the sub-conjunctival tissue.

These pimples may contain a minute quantity of lymph, which may (p 36) become organized into a raised vascular tubercle, or they may advance into the pustular stage, and form ulcers by opening on the surface, with a destruction of the anterior lastic lamina and the conjunctival epithelium. An opacity remains after they are healed, which is usually proportionate to the previous depth of the ulcer, but it is gradually lessened with the growth of the little patient, and often altogether disappears. Occasionally such an ulcer will heal with a depressed but nearly transparent surface, leaving a mark only apparent to others in certain positions of the eye, when the light is reflected from the part, but for the same reason painfully obvious to the patient himself (if it happen to be situated near the pupil) by the distortion of objects which it occasions.

Of opacities of the cornea—I shall now, gentlemen, say a few words concerning opacities of the cornea, such as are commonly left by a variety of causes in different portions of the corneal tissue, and shall endeavour to explain their nature and seat according to the particular tissue they affect

We have already seen that the proper laminated tissue is capable of enlarging its vascular resources for its support under disease, and for the subsequent removal of diseased products, to such an extent that if it have itself escaped disorganization, it is able, under favourable circumstances, to completely resume its transparency The nature of the nutritive process in the laminated tissue is such that this tissue recovers itself in a great measure, by timely treatment, from almost any amount of inflammation and consequent effusion which falls short of actual But when these elements are at all destruction of its elements displaced or consumed under the morbid process, then permanent opacity is very likely, and indeed almost certain, to follow, for so artificial is the mechanical arrangement of the elementary lamellae, on which the transparency of the cornea depends, that when their substance is once removed its place cannot be supplied with a tissue of an equally elaborate organization The new material, though its bulk and strength may be equivalent to those of the old, is fibrous instead of being lamellated, and opaque instead of being translucent It contains a considerable quantity of yellow tissue, intimately mixed with the white, and both most irregularly (p 37) interwoven and ill-developedready to become the nidus of small granules of earthy9 or fatty matter, such as readily settle in parts of deteriorated structure From this condition recovery is not possible, the blemish has become indelible

It is to be observed, however, that during the progress of the reparative process, there exists in the part and its immediate vicinity a quantity of fresh material of that kind which denotes an over-activity of the nutritive function, and which, not being employed for conversion into permanent tissue, will in due course be absorbed. This augments the opacity while it lasts, and it is not till a certain time has been allowed for its removal, after the healing of the breach, that we can say how extensive or deep the

⁹ The following is an example of ossification occurring in the centre of a dense leucoma A girl, aet 14, was brought to me last autumn, suffering from severe inflammation of the eye, which had been partially sunk several years before, and in which no perception of light remained. The irritation was very great, especially on every movement of the lid, and, on examination, I perceived a hard angular piece of bone imbedded in the front of a dense opacity of the cornea, and projecting beyond it, quite bare. It was easily removed with a pair of forceps, and the patient speedily got well. The fragment was the size of a large pin's-head.

permanent opacity may prove, we may generally venture to predict a gradual improvement during some time, in a recent opacity, particularly in young subjects

What I have now said applied to the greater part of the more common opacities of the cornea I may allude to one or two other forms which may prove interesting in regard to the question of their precise seat. There are some varieties which appear to be on or near the very surface of the cornea, and which it is probable may occupy the anterior elastic lamina The very opaque chalky-looking films which often follow the application of quicklime or new mortar to the eye, seem to be of this kind, and so, also, do those which have been supposed by some to be stainings of the surface of the corneal tissue by a deposit from the lead lotion in common use Occasionally we have a superficial excoriation of the cornea—one can hardly call it an ulcer—which the epithelium limits with abrupt edges, thus favouring the accumulation, on the depressed surface, of the frothy mucus or sud which the movements of the lid furnish The opacity thus produced is often very opaque, and unless you were aware of its cause, might (p 38) seem more serious than it really is or the point of a needle, will inform you of its real nature

There is another form of opacity, which I believe to have its seat in the anterior elastic lamina, although it is vain to endeavour to prove it, except by a section of the parts. It has a silvery lustre, and a very find texture of interweaving striae, and it creeps very gradually from near the border, over the surface of the cornea, towards the centre. The epithelial surface retains its smoothness and lustre, and the opacity does not appear to have much depth. Other varieties of opacity, very chronic in their course, and evidently not inflammatory, are liable to form, as I believe, in the same tissue. They may be of a brown tint, with an indefinite margin, and may affect both corneae at the same time. I am not aware that these are particularly described in books, nor whether they admit of removal, or even arrest. They are probably connected with an imperfect nutrition of the eyeball, and must be left to take their course.

There is a variety of opacity consisting of minute dots, some-

times so small as not to be distinguished separately without a lens, at others, as large as a small pin's head. These are evidently seated on the posterior part of the cornea, and may be referred to the posterior elastic lamina. They accompany an inflammatory affection in which the walls of the aqueous chambers seem to be chiefly involved, in which the iris is usually mottled and dull, the pupil inactive, and the sclerotica more or less injected. Such a dotted opacity was long since pointed out by Mr Wardrop, and admits of removal, provided the proper treatment is commenced early enough. It probably consists of an ordinary inflammatory deposit of lymph

There is still another kind of dotted opacity, occurring in the posterior elastic lamina (sometimes in the anterior also) which I would distinguish from all those yet mentioned, and which is met with in eyes which have suffered a slow disorganizing process, through sympathy with the opposite organ previously lost by operation or accident. In this the dots are remarkably round and separate from one (p. 39) another, often brownish, and therefore overlooked, and scattered pretty uniformly over a portion or the whole of the cornea. Though these sometimes grow fainter under appropriate treatment, I have never seen them altogether removed

Warty opacity of the cornea—It will readily be conceived that opportunities but seldom offer of submitting specimens of the several forms of opacity to exact scrutiny by the microscope On this account I shall make no apology for describing the appearances of an opaque spot which occurred on the front of the cornea of an ox, and which I examined in the fresh state—It was about an eighth of an inch across, slightly raised, and densely opaque, and it seemed to have been the result of an ulcer, for the lamellated tissue was involved to a slight depth, and had been replaced by new tissue, as represented in Fig 6—This new tissue was dense and fibrous, and hardly admitted the light to pass through it even when cut very thin. It contained a large admixture of irregular nuclei and elastic tissue passing in all directions—But what was most remarkable was, that this substitute for the proper corneal tissue was thrown up under the

conjunctival epithelium in the form of numerous papillae, arranged in much the same way as we find them in the more highly developed parts of the skin, though apparently without vessels, and of a texture too opaque to be precisely described epithelium over these papillae was likewise opaque and diseased, being composed of a compact aggregation of nucleated particles, which contained numerous opaque granules, and failed to present that regular gradation from the spheroidal to the scaly figure, The extreme surface only was which is natural in this situation scaly I cannot help regarding this morbid condition as one of considerable interest, both as a proof of the affinities of the anterior part of the cornea to the integumental (p 40) tissues, and as an example of the definite organization of the new materials into persistent forms, opaque and otherwise different from the original structure which they supplant, and incapable of remedy

I shall conclude the present lecture with a short description of the structure which replaces the cornea when wholly or partially destroyed, and which is liable to become bulged, so as to constitute the state known as staphyloma corneae

The whole thickness of the cornea, in a larger or smaller extent, having perished from any cause, the irish is exposed, and occupies the breach, becoming adherent to the border of the gap formed by the removal of the lost part If the contents of the globe do not further escape, and the eyeball consequently collapse, time is afforded for reparative processes to take place, by which the opening is filled with new material by granulation At first this new material is soft, vascular, and nearly on a level with the surrounding parts, and, if nature is allowed to proceed with her operations undisturbed, it gradually acquires firmness, toughness, and considerable density, so as to appear not unlike the original cornea, except that it is opaque It becomes covered with an epithelium continuous with the conjunctival, just as an ulcer of the skin acquires an investment of cuticle as it heals This process was first explained by Mr Wharton Jones, in an able paper published in the Medical Gazette, vol xxi, p 847

Now, in some cases, from causes which it is unnecessary for

me at present to specify, this cicatrix contracts more or less, and continues to retain the contents of the globe within their proper bounds, the patient experiencing little inconvenience beyond the loss of vision, but in other instances the new material begins after a time to evince its want of coherence and strength, by bulging slightly under the pressure occasioned by the accumulation of fluid behind it,—that is, of course, behind the iris, in the posterior chamber of the eye Should the projection increase beyond a certain size, it assumes an unsightly appearance, interferes with the movements of the lids, so as at last even to prevent their closure, and, in a word, grows into such a source of annoyance and irritation, that it requires to be got rid of. This is usually done by the knife, and the lens being allowed to escape, the eyeball permanently shrinks to a small size

(p 41) The whole substance of the cicatrix being shaved

EXPLANATION OF PLATE II

Fig I Relative size of the two surfaces of the cornea in one instance a, anterior surface, p, posterior surface

Fig 2 Tubes of the cornea of the ox, injected with mercury

Fig 3 Tubes of the human cornea, injected with mercury At a a extravasation has occurred

Fig 4 Vertical section of the human cornea near the surface elastic lamina, b, conjunctival epithelium, c, lamellated tissue, d, intervals between the lamellae, showing the position of the corneal tubes collapsed, e, one of the nuclei of the lamellated tissue, g, fibrous cordage sent down from the anterior elastic lamina Magnified 300 diameters

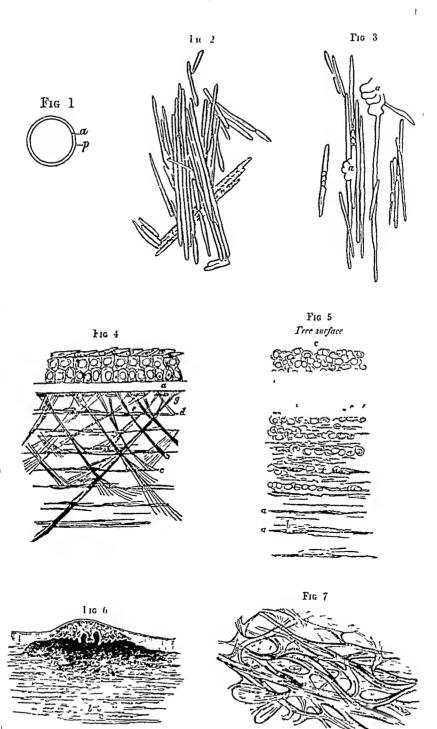
Fig 5 Vertical section of a minute ulcer on the surface of the cornea of a cat, three days after the application of caustic potass a, a, indicate the position of the corneal tubes in the sound tissue below the bed of the ulcer, b, nucleus of the lamellated tissue The surface of the ulcer is seen formed by a crowd of vesicular nuclei, most of them with a nucleolus These are in various stages, and mingled with finely granular matter Magnified 300 diameters

Fig 6 Vertical section of an opacity of the cornea of an ox a, new tissue in place of destroyed lamellated tissue papillae are developed on it, surmounted by opaque and thick conjunctival epithelium, or, as it might be here called, epidermis b, healthy lamellated tissue below the opaque spot slightly

Fig 7 Section of staphyloma, treated with acetic acid, from a girl Slightly

magnified

PLATE II



off from the front of the globe, affords us, now and then, the opportunity of examining its structure in the perfectly recent state, which we can seldom do with any other of the morbid tissues of which this organ is the seat I had such an opportunity last summer, in the case of a little girl, and the following, in few words, is a description of the structure of the tough opaque membrane which occupied the place of the lost cornea —Its thickness was very unequal, its posterior surface, to which portions of the iris adhered, being irregularly pitted, or, as it were, worm-eaten, its anterior surface was formed by a thickish coating of epithelium, somewhat resembling cuticle, being composed of eight or ten layers of cells, the deep ones globular, the superficial ones scaly, and more like epidermic cells than those of the healthy cornea There was no anterior elastic lamina, and no posterior elastic lamina The entire remaining portion of the thickness of the staphyloma consisted of a dense and most irregular interweaving of white and yellow fibrous tissue, with imperfectly developed nuclei intermingled, and the meshes of the tissues large, unequal, and open on all sides

In this condition we have an eminent example of those results of the reparative action, after loss of substance of the cornea, which we have already had occasion to notice as the consequence of ulcers or small sloughs, the chief difference being that here the new material is derived in a great measure, or wholly, from the vascular iris, rather than from the cornea itself. We see how far the reparative powers fall short of restoring the complex and elaborate structure of the cornea as it is originally laid down in the development of the body. The thickness of the new cuticle is attributable in part to the constant friction of the lids

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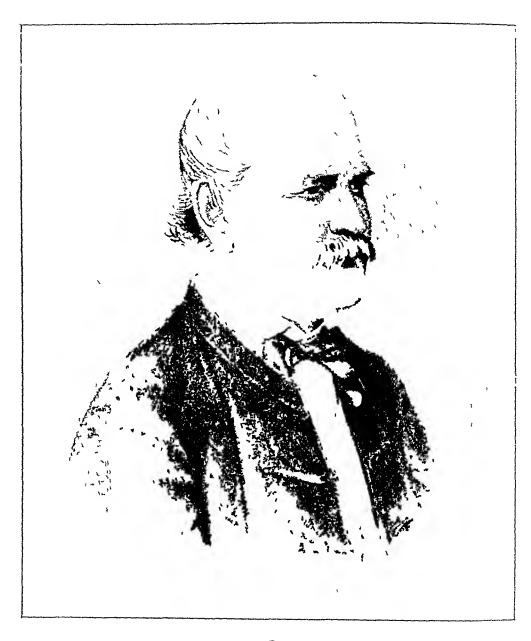
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Ignaz Philipp Semmelweis

BIOGRAPHY

- 1818 Born July 1, at Buda, in Hungary, the son of a merchant.
- 1835 Age 17 Entered the University of Pest
- 1837 Age 19 Sent by his father to Vienna to study law but changed to medicine
- 1844 Age 26 Received the M D degree from the University of Vienna
- 1847 Age 29 Appointed an assistant in the maternity department, division I, of the Allgemeines Krankenhaus in Vienna In May, introduced the use of chlorine water for washing the hands before examination of women in labor The mortality rate fell from ten to less than two percent Wrote his first paper on puerperal fever
- 1848 Age 30 With his brothers, fought in the war against Austria
- 1849 Age 31 Elected a member of the medical society in Vienna
- 1850 Age 32 In May and in June, delivered addresses on puerperal fever before the Vienna Medical Society In October, after waiting eighteen months for the appointment, became Privat-Docent of Midwifery at the Allgemeines Krankenhaus in Vienna Because so many restrictions were placed in his way and disgusted with the hostile reception of his theories, he returned to his homeland, Hungary, to Budapest Appointed director of the Obstetric Division of the St Rochus Hospital in Pest
- 1855 Age 37 Appointed Professor of Theoretical and Practical Midwifery in the University of Pest

- 1858 Age 40 Published the essential details of his doctrines on childbed fever in the Hungarian language in the Orvosi hetilap
- 1861 Age 43 Published his great work, The etiology, concept and prophylaxis of childbed fever
- on August 13th, died of blood poisoning resulting from an infected finger which had been wounded while performing his last post-mortem examination.

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INTRODUCTION

In 1847, three years after Oliver Wendell Holmes had written his classic paper *The contagiousness of puerperal fever* (see Medical Classics, vol 1, No 3, Nov. 1936), Ignaz Philipp Semmelweis composed his first work on puerperal fever. He apparently was not acquainted with Holmes' work. To Holmes naturally goes the honor of priority, but Semmelweis' recognition of puerperal fever as a septicemia, his incessant teaching and tragic life have made his name famous in the medical world.

The life work of Semmelweis was published in 1861 in a book of 549 pages, The etiology, concept and prophylaxis of childbed fever. This book has never been published in English. It has recently been translated by Dr. Frank P. Murphy, Associate Professor of Obstetrics at the Creighton University School of Medicine. It is now published in its entirety.

Semmelweis received a good medical education at the University of Vienna, where he studied under Hebra, Skoda and Rokitansky At the age of twenty nine he was appointed as an assistant in the maternity department, division I, of the Allgemeines Krankenhaus in Vienna Division I was used for the instruction of doctors and division 2 for midwives Division I was notorious for its higher mortality and pregnant women begged in tears not to be admitted there. Into division I went the medical students from the dissecting room and morgue. They often made vaginal examinations of the women in labor with hands unclean or improperly cleaned. Semmelweis himself made a careful study by autopsy of all the fatal cases of puerperal fever and sought an explanation of the frightful mortality and ways of controlling it

On his return from a short holiday, he found his friend and associate, Dr Kolletschka, dead of an infection which had resulted from a cut of a finger received in a postmortem examination Semmelweis recognized the changes in the body of his friend as those of childbed fever and he immediately established in his own mind the similarity of the infectious processes. He determined to teach that childbed fever is a pyemia resulting from the introduction of decomposed organic matter into the uterus during childbirth. He ordered that hands be washed in a calcium chloride

solution before vaginal examinations. The mortality dropped from 9.92 to about 2 per cent

Semmelweis' book covers in detail his conception of childbed fever and gives a thorough investigation to the attitude of his proponents and opponents. From this translation we can see why the work has never before been published in English. The style is wordy and repetitious, the argument flows back and forth without progressing to any logical point, the author is egotistic and bellicose. We are conscious of signs of Semmelweis' mental abberation and feeling of persecution. Many have thought that the persecution complex was due to the hostile reception of the author's book but the book itself discloses the underlying paranoia. If Semmelweis had only spent more time in clearly stating his views and less in argument his book would be twice as good and half as long! But that would not be Semmelweis as he really existed.

Many medical writers freely mention Semmelweis without ever having read any of his publications. They do this simply on hearsay from others, others who likewise have not read his actual words. Here then is an opportunity to have the complete translation of Semmelweis great book. His work and teaching were of paramount importance in establishing the true nature of childbed fever and in saving countless numbers of mothers and their babies.



The Etiology, the Concept and the Prophylaxis of Childbed Fever

BY

IGNAZ PHILIPP SEMMELWEIS

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Pest, Vienna and Leipzig
C A Hartleben's Verlags-Expedition

1861

Translation By Frank P Murphy, AM, MD
Associate Professor of Obstetrics, Creighton University School of Medicine

TRANSLATOR'S NOTE

Some ten years ago, the late Dr LeRoy Crummer permitted me to examine a copy of the original edition of Semmelweis' Kindbettfieber, which he had picked up in Europe a short time before—Since there was no translation of this historically important book into English, my curiosity about its content was aroused, so Dr Crummer very kindly and with little justification that I could perceive, allowed his valuable and rare copy to remain in my possession for the better part of a year—The following translation is based on the first one hundred pages or so of Dr Crummer's copy and the remainder comes from Semmelweis' Gesammelte Werke, herausgegeben von Tiberius von Gyory, Jena, 1905*

There has been no effort to render Semmelweis' German into anything like polished English, nor any determined attempt to use the medical vocabulary

^{*}This translation has been checked against a copy of the original edition which was kindly loaned by the Army Medical Library and has been found to follow it exactly —E C K

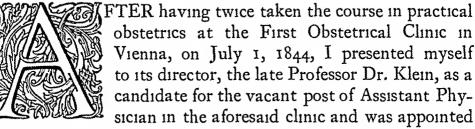
of the sixties As a consequence, many anachronisms may be found Some effort has been expended in making the translation as literal as possible, although many repetitions have been avoided

The mortality tables apparently refer only to deaths from childbed fever,

except where specification has been made

Thanks are due to the late Dr George Neuhaus, to Dr Charles Wilhelmj, Dr J Harry Murphy, Dr Nicholas Dietz and Mr Otto Marx for assistance and counsel

PREFACE



as such provisionally by a Decree dated February 27, 1846 On July 1, 1846, I definitely took over the post of Assistant, but on October 20 of the same year I had to withdraw in favor of my predecessor, Dr Breit, because he had obtained a two-year extension of his service in the meantime. For the sake of clearness, in the course of this treatise we shall refer to these four months, viz July, August, September and October of the year 1846 as my first period of service

The period of service for an Assistant in any department was fixed at two years in Vienna, but in every other department it was the custom, after the two years had passed, to prolong the Assistantship for two years more, but this practice was not observed in the obstetrical section and the Assistants were changed regularly every two years Dr Breit was the first to enjoy this good fortune

In the meantime, Dr Breit was elected Professor of Obstetrics at Tubingen University, and I took over the duties of Assistant for the second time on March 20, 1847, and functioned as such for two years, viz until March 20, 1849 These two years we shall refer to as my second period of service

The object of this treatise is to present to the reader an historical account of the observations, which I made at this clinic

during this period, to show him how I had become skeptical as to the current theory of the origin and nature of childbed fever, how my present conviction had been irresistibly forced upon me, so that he likewise may devote the fruits of this same conviction to the benefit of mankind

Because of my aversion to controversy, I did not reply to the numerous attacks on my doctrine, and I believed that I could break a path with facts as time went on, but during the thirteen years, which have elapsed, my expectations have not been fulfilled to the degree which is necessary for the benefit of humanity

Misfortune ordained that in the school years 1856-7 and 1857-8 at my own obstetrical clinic in Pest the puerperae should perish in such numbers, that my opponents were able to use this mortality as evidence against me, I can show however that these two unlucky years were just many sad, unintentional, inadvertent proofs for me

To this disinclination for controversy is added an innate aversion to everything in the nature of writing

Fate has chosen me as an advocate of the truths which are laid It is my imperative duty to answer for them down in this work I have abandoned the hope that the importance and the truth of the facts would make all conflict unnecessary My inclinations are of no moment alongside the life of those who take no part in the dispute over the justice of my claims or of those of my adversaries I am constrained to come before the public once more, since my silence has been futile, and despite the many bitter hours which I have suffered, yet I find solace in the consciousness of having proposed only conclusions based upon my own convictions

Pest, August 30, 1860

THE AUTHOR.

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Obstetrics is that branch of medicine, which obviously undertakes in many cases the most sublime task of all, namely the salvage of endangered human life. From amongst many examples, let us cite only the transverse presentation of a mature infant. Mother and child are doomed to certain death if the labor is left to Nature, while the timely intervention of accoucheur saves both by a maneuver, almost painless and consuming but a few minutes in time

This virtue of midwifery, with which I had already become familiar in the theoretic lectures on this specialty, I found indeed completely confirmed, when I had the opportunity in the great Vienna Lying-in Hospital to acquaint myself with its practical But in sorrow I saw that the number of cases in which the accoucheur can work so beneficently was insignificant compared with the great number of victims to whom he can only offer aid that is of no avail This darker aspect of midwifery is childbed fever Ten, fifteen versions have I seen performed in a year with the recovery of mother and child, but I have seen many hundreds of puerperae treated unsuccessfully for childbed fever (p 2) Not alone did I find the therapy unavailing, but the etiology was erroneous, since for childbed fever, for which I had seen so many hundred puerperae treated unsuccessfully, I could not find the causative agent in the etiology currently accepted

The great free Vienna Lying-in Hospital is divided into two parts, of which the one is called the First and the other the Second Division By an Imperial Decree of October 10, 1840, Court Commission of Study decree of October 17, 1840, No 65666, Administrative Order of October 27, 1840, No 61015, all medical students were assigned to the First and all pupil-midwives to the Second Division for instruction in midwifery Before this date, niedical students of obstetrics and pupil midwives were taught in equal numbers in either division. The admission of the waiting gravidae, parturients and puerperae was regulated as follows on Monday afternoon at four o'clock were begun the admissions to the First Division, and this continued until four o'clock, Tuesday afternoon, on Tuesday afternoon at four o'clock,

admissions began in the Second Division and continued until four o'clock Wednesday afternoon. On Wednesday afternoon, admissions to the First Division started again and continued until Thursday afternoon at four o'clock, when the Second Division took the admissions again and continued to do so until Friday afternoon at four o'clock. On Friday afternoon at four o'clock, they changed over to the First Division again for 48 hours until Sunday afternoon at four o'clock, when the admissions went to the Second Division and continued thus until four o'clock Monday afternoon, consequently admissions were made to each division each alternate twenty-four hours. Once

Physician's Division Midwives' Division Births % Births Deaths Year Deaths % 3036 86 1841 237 2442 3 5 1842 3287 518 15 8 2659 202 7 5 1843 3060 8 9 169 274 2739 59 68 1844 260 3157 2956 2 3 6 8 66 1845 3241 2 03 3492 241 1846 4010 11 4 27 3754 105 459 Total 1,989 691 20,042 9 92 17,791 3 38

TABLE I

only during the week, admissions lasted through 48 hours in the First Midwifery Clinic The First Division had therefore four admission days a week, the Second (p. 3) Division three weekly, therefore the First Division had 52 more admission days a year

The mortality in the First Division, since it was devoted exclusively to the instruction of accoucheurs, remained constant until June, 1847, in 1846 it became even five times greater, and for a period of six years, on the average three times greater than in the Second Division, in which pupil-midwives only were taught, as Table I shows

The difference in mortality between the two Divisions, as great as this table shows it to be, was in truth much greater, because at times, for reasons we shall discuss later, due to the increasing mortality, all ill puerperae were transferred from the

First Division to the General Hospital, died there, and then were entered in the returns of the General Hospital as deaths, but not in those of the Lying-in Hospital. The report of the First Division thus showed, when transfers were made, a small percentage of mortality, because only those died there who could not be transferred on account of a rapid course of the disease, (p 4) while as a matter of fact an enormous number of puerperae perished. In the Second Division, transfers were never made to such an extent, because only single puerperae were removed, whose condition was such as to be too dangerous for those remaining

This augmented mortality in the First Division, as compared with the Second, includes the many hundred puerperae, a part of whom I saw die of the puerperal disease without being able to discover a causative principle for it in the currently accepted etiology

In order to convince the reader that this inordinate mortality cannot be explained by the etiology currently accepted, we shall now subject to a closer scrutiny the currently accepted etiological factors for childbed fever as employed in the explanation of the augmented mortality

There was no doubt, and it has been so stated a thousand times, that the frightful havoc which childbed fever has inflicted upon the First Division must be ascribed to epidemic influences. As epidemic influences are to be understood certain hitherto inexplicable, atmospheric, cosmic, telluric changes, which sometimes disseminate themselves over whole countrysides, and produce childbed fever in individuals disposed thereto by the puerperal state. Now, if the atmospheric-cosmic-telluric conditions of the City of Vienna are so disposed that they cause puerperal fever in individuals susceptible thereto as puerperae, how does it happen that these atmospheric-cosmic-telluric conditions over such a long period of years have carried off individuals disposed thereto as puerperae in the First Clinic, while they have so strikingly spared others also in Vienna, even in the same building in the Second Division and similarly vulnerable as puerperae? (p 5) To me, there is not the slightest doubt that, if the devastation

by childbed fever at the First Clinic must be attributed to epidemic influences, then these same influences must be effective also in the Second Clinic with very small variations, otherwise one will be forced to the absurd assumption that the epidemic influences must be subject to twenty-four hour remissions and exacerbations in their pernicious activity, and that the remissions through successive years just coincide with the admission days for the Second Clinic, while the exacerbations over a number of years set in exactly at the time admissions are made to the First Division But even then, if one might accept so manifest an absurdity, the difference in mortality between the two divisions under epidemic influences will not be explained The epidemic influences are working upon the individual either before her admission to the lying-in hospital, or they work upon her during If they affect the individual outside the maternity hospital, then those admitted to the First Division are certain, as well as are those who present themselves at the Second Division for admission, to be exposed to the pernicious action of the epidemic influences outside the lying-in hospital, and then such a great difference in the mortality ratios could not exist in the two divisions, both of which admit individuals subject to epidemic But if the epidemic influences affect an individual during her sojourn in the maternity hospital, then again there could be no difference in the mortality ratios, because the two divisions, which are so close to each other that they have a common anteroom, must necessarily be subject to the same atmospheric-cosmic-telluric influences (p 6) These were the considerations which forced upon me the unshakeable conviction that it was not the epidemic influences which wrought the frightful havoc among the puerperae in the first Obstetrical Clinic

After this unshakeable anti-epidemic conviction had once taken possession of me, many reasons soon presented themselves which made me more and more firm in my conviction We shall take them up as follows

If the atmospheric influences in the city of Vienna provoked the epidemic of childbed fever, the childbed fever—since the population of the city of Vienna was exposed to the same in-

fluences—should of necessity prevail among the puerperae in the city, but actually during the greatest height of the puerperal disease in the lying-in hospital there was not observed, either in Vienna or in the rural districts, any increased morbidity among the puerperae

When cholera is epidemic, as is well known, not only the inmates of a hospital but even the population itself is affected

A very frequent and certainly a successful measure for arresting the progress of an epidemic of childbed fever is to close the lying-in hospital. The lying-in hospital is not closed with the intention that the puerperae should die outside of the hospital, but with the conviction that if they deliver in the lying-in hospital they will succumb to the epidemic influences, and if they are confined outside, they will remain healthy. Thus it is proven that there is no epidemic to deal with i.e. a disease which depends upon atmospheric influences, because the atmospheric influences reach beyond the walls of the lying-in hospital (p. 7) and extend to the parturients and puerperae in any corner whatsoever of the city, thus it is shown that these are endemics, i.e. a disease which is the result of causes confined within the walls of the lying-in hospital

What would the advocates of the epidemic theory say, if somebody should suggest that, in order to put down the cholera epidemic, it would be best to close the cholera hospitals?

Puerperal fever, which is the result of a traumatic cause, e.g. a difficult forceps delivery, is during its course and in its anatomic findings the same as it is in the so-called epidemic form. Can indeed any other epidemic disease be engendered by traumatic means?

Epidemics have periodic intermissions, but childbed fever has raged continuously for a long period of years in the First Obstetrical Clinic with but trifling interruptions. Is cholera epidemic every year?

If the so-called epidemic of childbed fever were actually dependent upon atmospheric influences, it could not then occur during the different seasons of the year and in the various climates, as a matter of fact, epidemics of childbed fever have been observed at all seasons of the year, in different climates and under all sorts of atmospheric conditions

In order to prove to the reader numerically that the seasons of the year actually have no part in the origin of childbed fever, we shall again refer to the period covered in Table No 1, and also with the addition of the first five months of the year 1847. These figures will show that each month in the year had offered a favorable and an unfavorable state of health for the puerperae at the First Clinic. The month of December, 1841 only (p. 8) cannot be used because I have lost the memoranda, showing how many births took place and how many puerperae died during this month. But this month may be placed with those, during which many puerperae died, because it lies between two months, in which the state of health of the puerperae was a wretched one. In November, 1841, 53 out of 235 puerperae (22 55%) died. In January, 1842, there died 64 out of 307 puerperae, 20 84%.

(p 10) The reader will observe, that the epidemic influences are so powerful that their pernicious activity cannot be restrained at any season of the year, that they rage in the depth of winter and during the oppressive summer heat with equal violence, however, the epidemic influences are partial in that they do not scourge all lying-in hospitals to the same extent, but spare certain institutions and decimate the inmates of others without mercy. Indeed they go so far in their partiality, as even to attack with unequal severity different sections of one and the same institution.

It is a fact that lying-in hospitals which have no departments devoted to teaching, or are used only for the instruction of midwives, are with few exceptions in better condition than those given over to the training of accoucheurs

Table I shows the ratio between the mortality statistics of two divisions of one and the same establishment, a similar thing occurred in two departments of one hospital in Strassburg

We shall go into these conditions more in detail later on

These findings have strengthened more and more my conviction that the enormous mortality in the First Obstetrical Clinic is not caused by epidemic influences, but that there are endemic

noxious agents which manifest themselves in such a frightful fashion only within the limits of the First Obstetrical Clinic

TABLE II

Month	Year	Mat Deaths	Births	Percent
	1847 Min	10	311	3 21
Jan	1842 Max	64	307	20 84
	1847 Min	6	312	1 92
Feb	1846 Max	53	² 93	18 08
	1847 Min	11	305	3 60
March	1846 Max	48	311	14 53
	1841 Min	4	² 55	1 57
Apr	1846 Max	48	² 53	18 97
	1841 Min	2	255	0 74
May	1846 Max	41	305	13 44
	1844 Min	6	224	2 67
June	1846 Max	27	266	10 15
	1843 Min	I	191	0 52
July	1842 Max	48	231	20 79
	1841 Min	3	222	1 35
Aug	1842 Max	55	216	25 46
_	1844 Min	3	245	1 22
Sept	1842 Max	41	223	18 38
_	1844 Min	8	248	3 22
Oct	1842 Max	71	242	29 33
	1843 Min	18	252	7 14
Nov	1841 Max	53	235	22 55
_	1846 Min	16	298	5 37
Dec	1842 Max	75	239	31 38

But, if we examine the hitherto accepted endemic causes in their application to the difference in mortality rate between the two Vienna Free Divisions, they will show that either there could be no difference in the extent of the mortality, or if even a difference were possible, a greater mortality must have prevailed in the (p. 11) Second Obstetrical Clinic, where there actually was a smaller mortality

If overcrowding were the cause of the fatalities in the First Obstetrical Clinic, then the mortality in the Second Obstetrical Clinic should have been still greater because the Second Obstetrical Clinic was even more overcrowded than the First bad repute of the First Obstetrical Clinic was such that everyone strove for admission into the Second Clinic, and thus it often happened that the Second Division, although the appointed time drew near, could not take over the admissions because there was no room for the new arrivals, or even if new admissions were taken in, then, after the passage of only a few hours until the appointed time was up, they must be returned to the First Division, because such an enormous crowd of people in the corridors awaited the time for the shift of the admissions from the First Clinic to the Second, that, during the course of a rather short time, all the available places were occupied. During the five years which I spent in the First Clinic, it was never once necessary, on account of overcrowding, to turn the admissions over to the Second Clinic before the appointed time, even though at the First Clinic the admissions continued for 48 hours without a break. and in spite of this overcrowding, the mortality in the Second Clinic was strikingly less

The First Clinic had indeed several hundred more deliveries every year than did the Second Division, but there was assigned to it a greater amount of floor space, because it had one more admission-day a week. Hence the Second Division, in spite of the smaller number of births (p. 12) was more overcrowded in proportion to its capacity. In proof of this, either it certainly could not take over the admissions more frequently, or it must give them up before the appointed time, which did not occur in five years in the First Clinic, as already stated, although each week the admissions continued without a break for 48 hours, had the Second Division the necessary room, so that it could accept all the applicants who applied there for admission, then,

(p 13)

TABLE III

Chinic for Physicians

Year Month	No of Births	Deaths	Percent of Deaths	Year Month	No of Births	Deaths	Percent of Deaths
1841				Mar	276	47	17 03
Jan	254	37	14 56	Apr	208	36	17 30
Feb	239	18	7 53	May	240	14	5 83
Mar	277	12	4 33	June	224	6	2 67
Apr	255	4	I 57	July	206	9	4 37
May	255	2	0 78	Aug	269	17	6 32
June	200	10	5 00	Sept	245	3	I 22
July	190	16	8 42	Oct	248	8	ì
	222	1		Nov	ž .	1	3 22
Aug	(3	00	t t	245	27	
Sept	213	4	1 87	Dec	256	27	10 55
Oct	236	26	11 00	-0			
Nov	235	53	22 00	1845			
Dec		Missing		Jan	303	23	7 59
	1		}	Feb	274	13	5 11
1842				Mar	292	13	4 45
Jan	307	64	20 84	Apr	260	11	4 23
Feb	311	38	12 21	May	296	13	4 39
Mar	264	27	10 23	June	280	20	7 14
Apr	242	26	10 74	July	245	15	6 12
May	310	10	3 22	Aug	251	9	3 58
June	273	18	6 60	Sept	237	25	10 55
July	231	48	20 79	Oct	283	42	14 84
Aug	216	55	25 46	Nov	265	29	10 94
Sept	223	41	18 38	Dec	267	28	10 48
Oct	242	71	29 33	1	/		4-
Nov	209	48	22 96	1846		[
Dec	239	75	31 38	Jan	336	45	13 39
	-39	/3	3- 30	Feb	3	45	18 08
1843				Mar	293	53	
Jan	272	F2	10.11	Apr	311	48	15 43
Feb	263	52	19 11	May	253	48	18 97
Mar	266	42	15 96	-	305	41	13 44
Apr	285	33	12 40	June	266	27	10 15
May		34	11 93	July	252	33	13 10
June	246	15	6 10	Aug	216	39	18 05
July	196	8	4 08	Sept	271	39	14 39
Aug	191	I	0 52	Oct	254	38	14 98
	193	3	I 55	Nov	297	32	10 77
Sept Oct	221	5	2 26	Dec	298	16	5 37
	250	44	17 60	1			
Nov	252	18	7 14	1847			
Dec	236	19	8 05	Jan	311	10	3 21
. 6				Feb	312	6	1 92
1844				Mar	305	11	3 69
Jan D.	244	37	15 16	Apr	312	57	18 27
Feb	257	29	11 28	May	294	36	12 24

in spite of the fact that it had 52 fewer admission days by law assigned to it yearly, it would have turned out by far a greater number of births than did the First Division

But if we omit entirely a comparison of the First Division with the Second in reference to overcrowding and consider only the different degrees of overcrowding, as it occurs at the First Obstetrical Clinic according as a greater or a lesser number of puerperae were cared for in the different months, then it shows that the more favorable or less favorable state of health does not depend upon a greater or lesser degree of overcrowding of the First Division. We shall use again the period represented by Table I, with the addition of the first five months of the year 1847, excluding however December of 1841, because we have lost the figures for this month

During these 76 months, the number of deaths is in proportion to the number of deliveries as Table III shows.

(p 14) During these 76 months, the greatest number of puerperae cared for during any one month was 336, therefore the greatest overcrowding occurred in January, 1846, of which number 45 died, or 13.39%. In 13 of these 76 months, the absolute mortality was greater among a rather small number of births, therefore in a lesser overcrowding, as Table IV shows

But if we consider the relative mortality, then with the consideration of Table IV, the relative mortality in case of a lessened overcrowding during 24 months, was greater than in case of the largest number of births, i.e. the greatest over-crowding in January, 1846, as Tables IV and V show.

But if we consider not only the total mortality, but, at the same time the season of the year, then it shows that only in the months of March and April along with the largest number of puerperae, likewise in case of the greatest overcrowding, does the greatest absolute mortality appear, as Table No VI shows.

(p. 17) But if we compare the relative mortality and the season of the year, then it is shown that, in the case of the greatest number of puerperae, ie the greatest overcrowding, the greatest relative mortality never occurs simultaneously, as Table VII shows

But if we arrange the individual months according to the number of births occurring in them, ie according to the degree of overcrowding present, along with the gradual decrease of the

TABLE IV
(First Division)

Month	Year	Births	Deaths	Percent	Births Less	More Deaths
Jan	1846	336	45	13 39		
Apr	1847	312	57	18 27	24	12
Mar	1846	311	48	15 43	25	3
Jan	1842	307	64	20 84	29	19
Feb	1846	293	53	18 08	43	8
Mar	1844	276	47	17 03	60	2
Jan	1843	272	52	19 11	64	7
Apr	1846	253	48	18 97	83	3
Oct	1842	242	71	29 33	94	26
Dec	1842	239	75	31 38	97	30
Nov	1841	235	53	22 55	101	8
July	1842	231	48	20 79	105	3
Aug	1842	216	55	25 46	120	10
Nov	1842	209	48	22 96	127	3

(p 15) TABLE V
The greatest overcrowding was in January 1846 with 336 deliveries, out of which 45 died, 13 39%

Month	Year	Births	Deaths	%	Births Less
May	1846	305	41	13 44	31
Oct	1845	283	42	14 84	53
Sept	1846	271	39	14 39	65
Feb	1843	263	42	15 96	73
Jan	1841	254	37	14 56	82
Oct	1846	254	38	14 98	82
Oct	1843	250	44	17 60	86
Jan.	1844	244	37	15 16	92
Sept	1842	223	41	18 38	113
Aug	1846	216	39	18 05	120
Apr	1844	208	36	17 30	128

number of births, i e the gradual decrease of overcrowding, there appears no corresponding decrease of mortality as Table No. VIII shows

Medical Classics

TABLE VI

Year	Births	Deaths	%	Births Less	Deaths More
		Janu	iary		
1846	336	45	13 39		
1842	307	64	30 61	29	19
1843	272	52	19 11	64	7
		Febr	uary		
1847	312	6	1 92		
1842	311	38	12 21	I	32
1846	293	53	18 08	19	47
1845	274	13	5 11	38	7
1843	263	42	15 96	49	36
1844	257	29	11 28	55	23
1841	239	18	7 53	73	12
		Ma	rch		
1846	311	48	15 43		
		Ap	rıl*		
1847	312	57	18 27		
		М	ay		
1842	310	10	3 22		
1846	305	41	13 44	5	31
1845	296	13	4 30	14	3 26
1847	294	36	12 24	16	
1843	246	15	6 10	64	5
1844	240	14	5 83	70	4
		Ju	ne	···	
1845	280	20	7 14		
1846	266	27	10 15	14	7
		Ju	ıly		<u> , </u>
1846	252	33	13 10		
1842	231	48	20 79	21	15
		Aug	gust		
1844	269	17	6 02		
1842	216	55	25 46	53	38
1846	216	39	18 05	53	22

^{*} In the remaining homonymous months there was in the case of a lesser number of births, a smaller absolute mortality

TABLE VI-Concluded

Year	Births	Deaths	%	Births Less	Deaths More
		Septe	mber		
1846 1842	271	39 41	14 39 18 38	48	2
	· · · · · · · · · · · · · · · · · · ·	Octo	ber		
1845 1843 1842	283 250 242	42 44 71	14 84 17 60 29 33	33	2 29
		Nover	nber		
1846 1841 1842	297 235 209	3 ² 53 4 ⁸	10 77 22 55 22 96	62 88	21 16
		Decen	nber		
1846 1845 1844 1842 1843	298 267 256 239 236	16 28 27 75 19	5 37 10 48 10 55 31 38 8 50	31 42 59 62	12 11 59 3

But if we compare the single months, according to the absolute mortality, then there appears no corresponding gradual decrease of births, i.e. a decrease of overcrowding, as Table No IX shows

Now if we arrange the single months according to the relative mortality, then, along with the gradual decrease of the relative mortality, there appears no corresponding gradual decrease in the number of births occurring at that time, nor any gradual decrease in the overcrowding, as Table No X shows

But if we arrange all of the 76 months according to the number of births occurring in them, i.e. according to the degree of over-crowding, then there appears no gradual decrease of mortality corresponding to it, as Table No XI shows

But if we take the single months according to the absolute mortality, there is shown no proportional decrease in the number of births, or in other words, no corresponding decrease in the overcrowding as Table No XII shows

TABLE VII

	1 5 .7	Deaths	01	n
Year	Births	Deaths	%	Births Les
		January		
1846	336	45	13 39	
1842	307	64	20 84	29
1843	272	52	19 11	64
1841	254	37	14 56	82
1844	244	37	15 39	92
		February		
1847	312	6	1 92	
1842	311	38	12 21	ı
1846	293	53	18 08	19
1845	274	13	5 11	38
1843	263	42	15 96	49
1844	257	29	11 20	55
1841	239	18	7 53	73
		March		
1846	311	48	15 43	
1844	276	47	17 03	35
	•	April		- 4
1847	312	57	18 27	
1846	253	48	18 97	59
		May		
1842	310	IO	3 22	
1846	305	41	13 44	5
1845	296	13	4 39	14
1847	294	36	12 24	16
1843	246	15	6 10	64
1844	240	14	5 83	70
		June		
1845	280	20	7 14	
1846	266	² 7	10 15	14
		July		
1846	252	33	13 10	
1842	231	48	20 79	21
		August		
1844	269	17	6 32	
1846	216	39	18 05	53
1842	216	55	25 10	53

TABLE VII-Concluded

				
Year	Births	Deaths	%	Births Less
		September		
1846	271	39	14 39	
1842	223	41	18 39	48
		October		
1845	283	42	14 84	
1846	254	38	14 98	29
1843	250	44	17 60	33
1842	242	71	² 9 33	41
		November		
1846	297	32	10 77	
1845	265	29	10 94	32
1844	245	27	11 00	52
1841	235	53	22 55	62
1842	209	48	22 96	88
		December		
1846	298	16	5 37	
1845	267	28	10 48	31
1844	256	27	10 55	42
1842	239	75	31 38	59
1843	236	19	8 05	62

But if we arrange the individual months according to the relative mortality, there appears no corresponding lesser number of births, or in other words, no lessened amount of overcrowding, as Table No XIII shows

One might think that a place, in which so many thousand individuals have been delivered, endured the lying-in, been attacked by childbed fever and died, must necessarily be so tainted, that it is not so surprising, if in such a place childbed fever was on the increase. If this be the case, then again the greater mortality should prevail in the Second Obstetrical Clinic, because fearful epidemics of puerperal fever raged in the locale of the Second Clinic in Boer's time, at a time when the buildings of the First Division had not yet been erected

It is believed that the ill repute of the institution causes the

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311 307 303 272 254	10 64 23	3 21 20 84		252		
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272 254		7 59	1844	206	<i>}</i>	20 79
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	-ch		1846 '	271	39	14 39
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311	48	15 43		237	25	10 55
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	13			221	5	2 26
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		4 39		Decer	nber	
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			1846	298	16	5 37
			1845	267	28	10 48
240	14	5 83	1844		27	10 55
Tire	16		1842		, ,	31 38
			1843	236	19	8 05
			{			
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			11151						
Year	Deaths	%	Births	Year	Deaths	%	Births		
	Janu	ıary		July					
1842	64	20 84	307	1842	48	20 79	231		
1843	52	19 11	272	1846	33	13 10	252		
1846	45	13 39	336	1841	16	8 42	190		
1841	37	14 56	254	1845	15	6 12	245		
1844	37	15 16	244	1844	9	4 37	206		
1845	23	7 59	303	1843	ı	0 52	191		
1847	10	3 21	311		Am	nist			
	Febr	uary		August 55 25 46 216					
1846	53	18 08	293	1846	39	18 05	216		
1843	42	15 96	263	1844	17	6 32	269		
1842	38	12 21	311	1845	9	3 58	251		
1844	29	11 28	257	1841	3	1 35	222		
1841	18	1	239	1843	3	1 55	193		
1845	1	7 53 5 11	² 39				-33		
1847	13	1 92	312	l	Septe	mber	,		
104/			312	1842	41	18 38	223		
	Ma	rch		1846	39	14 39	271		
1846	48	15 43	311	1845	25	10 55	² 37		
1844	47	17 03	276	1843	5	2 26	221		
1843	33	12 40	266	1841	4	1 87	213		
1842	27	10 23	264	1844	3	1 22	245		
1845	13	4 45	292		Oct	ober			
1841	12	4 33	277	1842	71	29 33	242		
1847	11	3 60	305	1843	44	- 9 33	250		
	Ap	ril		1845	42	14 84	283		
1847	57	18 27	312	1846	38	14 98	254		
1846	48	18 97	253	1841	26	11 00	236		
1844	36	17 30	208	1844	8	3 22	248		
1843	34	11 93	285			ember			
1842	26	10 74	242				1		
1845	11	4 23	260	1841	53	22 55	² 35		
1841	4	1 57	255	1842	48	22 96	209		
				1846	32	10 77	297		
		ay	,	1845	29	10 94	265		
1846	41	13 44	305	1844	27	11 00	245		
1847	36	12 24	294	1843	18	7 14	252		
1843	15	6 10	246		Dece	ember			
1844	14	5 83	240	1842	75	31 38	239		
1845	13	4 39	296	1845	28	10 48	267		
1842	10	3 22	310	1844	27	10 55	256		
1841	2	0 76	255	1843	19	8 05	236		
	Ju	ne		1846	16	5 37	298		
1846	27	10 15	266						
1845	20	7 14	280						
1842	18	6 60	273						
1841	10	5 08	200	}					
1843	8	4 08	196						
1844	6	2 67	224						
									

TABLE XII

TABLE AII									
Month	} ear	Deaths	Percent	Births	Month	Year	Deaths	Percent	Births
Dec	1842	75	31 38	239	June	1846	27	10 15	266
Oct	1842	71	29 33	242	Oct	1841	26	11 00	236
Jan	1842	64	20 84	307	Apr	1842	26	10 74	242
Apr	1847	57	18 27	302	Sept	1845	25	10 55	337
Aug	1842	55	25 46	216	Jan	1845	23	7 59	303
Nov	1841	53	22 55	235	June	1845	20	7 14	280
Feb	1846	53	18 08	293	Dec	1843	19	8 05	196
Jan	1843	52	19 11	272	Feb	1841	18	7 59	239
Nov	1842	48	22 96	209	Nov	1843	18	7 14	252
July	1842	48	20 79	231	June	1842	18	6 60	272
\mathbf{Apr}	1846	48	18 97	253	Aug	1844	17	6 32	269
Mar	1846	48	15 43	311	July	1841	16	8 42	190
Mar	1844	47	17 03	276	Dec	1846	16	5 57	298
Jan	1846	45	13 39	336	July	1845	15	6 12	245
Oct	1843	44	17 60	250	May	1843	15	6 10	246
Feb	1843	42	15 96	263	May	1844	14	5 83	240
Oct	1845	42	14 84	238	Feb	1845	13	5 17	274
Sept	1842	41	18 38	223	Mar	1847	13	4 45	292
May	1846	41	13 44	305	May	1845	13	4 39	296
Aug	1846	39	18 05	216	Mar	1841	12	4 33	260
Sept	1846	39	14 39	271	Mar	1847	11	3 60	305
Oct	1846	38	14 38	254	June	1841	10	5 00	200
Feb	1842	38	12 21	311	May	1842	10	3 22	310
Jan	1844	37	15 16	244	Jan	1847	10	3 21	311
Jan	1841	37	14 54	254	July	1844	9	4 37	206
Apr	1844	36	17 30	208	Aug	1845	9	3 68	251
May	1847	36	12 24	294	June	1843	8	4 03	296
Jan	1841	35	14 56	254	Oct	1844	8	3 22	248
Apr	1843	34	11 98	285	June	1844	6	2 67	224
July	1846	33	13 10	252	Feb	1847	6	2 92	312
Mar	1843	33	12 40	266	Sept	1843	5	2 26	221
Nov.	1846	32	10 77	297	Sept	1841	4	1 87	213
Feb	1844	29	11 28	257	Apr	1841	4	1 57	255
Nov	1845	29	10 44	265	Aug	1843	3	I 55	193
Dec	1845	28	10 48	267	Aug	1841	3	1 35	122
Dec	1844	27	10 55	256	Sept	1844	3	1 22	245
Nov	1844	27	11 00	245	Sept	1841	2	0 78	255
Mar	1842	27	10 23	264	July	1843	1	0 52	191
		<u> </u>	1	· · · · · ·	<u> </u>		<u> </u>	<u></u>	<u> </u>

Division can readily be demonstrated, because one must endure heart-rending scenes, when women, wringing their hands, beg on bended knee (p 33) for their release, in order to seek admission to the Second Division, after having hit upon the First Division

TABLE XIII

Dec 1842 31 38 75 239 Dec 1845 10 48 28 267 Oct 1842 29 33 71 242 Mar 1842 10 23 27 264 Nov 1842 25 46 55 216 June 1846 10 15 27 266 Nov 1841 22 26 48 209 July 1841 8 42 16 190 Nov 1842 22 96 48 209 July 1841 8 42 16 190 Jan 1842 22 96 48 231 Feb 1847 75 32 38 55 19 296 Jan 1843 19 11 52 272 June 1845 7 14 20 280 Apr 1846 18 97 48 253	Month	Year	Mort %	Deaths	Births	Month	Year	Mort %	Deaths	Births
Oct 1842 29 33 71 242 Mar 1842 10 23 27 264 Aug 1842 25 46 55 216 June 1846 10 15 27 266 Nov 1841 22 55 53 235 Dec 1843 8 05 19 296 Jan 1842 20 84 64 307 Jan 1845 7 59 23 303 July 1842 20 79 48 231 Feb 1841 7 53 18 239 Jan 1846 18 97 48 231 Feb 1841 7 53 18 239 Jan 1846 18 97 48 253 Nov 1843 7 14 20 280 Apr 1846 18 88 41 223 June 1842 6 6 18 272 Feb 1846 18 05 39 216 May 1843 6 10	Dog	T842	21 28	75	220	Dec	1845	10 48	28	267
Aug 1842 25 46 55 216 June 1846 10 15 27 266 Nov 1841 22 26 48 209 July 1841 8 42 16 190 Nov 1841 22 25 5 53 235 Dec 1843 8 05 19 296 Jan 1842 20 84 64 307 Jan 1845 7 59 23 303 July 1842 20 79 48 231 Feb 1841 7 53 18 239 Jan 1843 19 11 52 272 June 1845 7 14 20 280 Apr 1846 18 97 48 253 Nov 1843 7 14 18 252 Sept 1842 18 38 41 223 June 1842 6 60 18 273 Apr 1847 18 27 57 312 Aug 1844 6 32 17 269 Feb 1846 18 05 39 216 May 1845 6 12 15 245 Oct 1843 17 60 44 250 May 1844 5 83 14 240 Apr 1844 17 03 47 276 Feb 1845 5 11 13 274 Feb 1844 15 96 42 263 June 1841 5 00 10 200 Mar 1844 15 16 37 244 June 1844 4 37 9 206 Oct 1845 14 84 42 238 Mar 1845 4 45 13 292 Jan 1844 5 13 48 311 Mar 1845 4 45 13 292 Jan 1844 15 16 37 244 June 1844 4 37 9 206 Oct 1846 14 98 38 254 Apr 1845 4 23 11 260 Oct 1846 14 98 38 254 Apr 1845 4 23 11 260 Oct 1846 14 98 38 254 Apr 1845 4 23 11 260 Oct 1846 14 98 38 254 Apr 1845 4 23 11 260 Oct 1846 14 98 38 254 Apr 1845 4 23 11 260 Oct 1846 14 39 39 271 Mar 1844 4 37 9 206 Feb 1846 15 34 48 311 Mar 1845 4 23 11 260 Oct 1846 14 98 38 254 Apr 1845 4 23 11 260 Oct 1846 13 44 41 305 Aug 1844 3 3 22 277 Jan 1846 13 34 41 305 Aug 1847 3 21 10 311 July 1846 13 10 33 252 Oct 1844 3 22 8 248 Mar 1846 13 34 41 305 Aug 1847 3 21 10 311 May 1846 13 10 33 252 Oct 1844 3 22 8 248 Mar 1843 11 24 0 33 266 Jan 1847 3 21 10 311 May 1847 12 24 36 299 June 1844 1 1 57 4 255 Oct 1841 11 00 27 245 Apr 1841 1 57 4 255 Oct 1841 11 00 27 245 Apr 1841 1 57 4 255 Oct 1841 11 00 27 245 Apr 1841 1 57 4 255 Oct 1841 11 00 26 236 Aug 1841 1 57 4 255 Oct 1841 11 00 26 236 Aug 1841 1 55 3 193 Nov 1845 10 94 29 257 Sept 1841 1 55 3 193 Nov 1845 10 94 29 265 Aug 1841 1 55 3 193 Nov 1845 10 94 29 265 Aug 1841 1 55 3 193 Nov 1845 10 77 22 297 Sept 1841 1 25 255		, .	\$	6 I		11		J .	Į.	, ,
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because of unfamiliarity with the place, which the presence of many men made clear to them. Puerperae with uncountable pulse-rates, enormously distended abdomens, dry tongues, 1 e gravely ill with puerperal fever, assured me a few hours before

death, that they were entirely well, in order to escape treatment by the physicians, because they realized that such treatment was the forerunner of Death In spite of this, I could not convince myself that fear was the cause of the greater mortality in the First Division, because I as a physician could not understand how terror, a psychic state, could produce such material changes as are found in childbed fever Besides this, a longer period must have gone by and a greater mortality must necessarily have taken place, before it became known among the people, to whom the lying-in hospital statistics are not accessible, that more persons die in one division than in another The origin of the mortality is not to be explained by fear

Even the religious usages do not escape blame The chapel of the hospital is so situated that the priest on leaving to administer the Last Sacraments could enter the sick-wards of the Second Clinic without passing through the other lying-in rooms, while in the First Clinic he must pass through five rooms to reach the sick-wards, because they are the sixth rooms beyond the chapel. The priest was wont to visit the sick in his vestments, attended and preceded by a sacristan ringing a bell, according to the Catholic rite, in order to administer the Holy Last Sacraments to them An effort was made to see that there was only one such visit a day, but 24 hours are a very long time for childbed fever, and many patients, (p 34) who were indeed tolerably well during the visit of the priest and therefore did not receive the Last Sacraments, after the course of a few hours became so ill that the priest must again be summoned. One can imagine what an impression the ominous sound of the little bell, heard frequently during the day, made upon the puerperae present As for myself, it made me uneasy in spirit when I heard the little bell hurrying past my door, a sigh stole from my breast for the new victim, who fell before this unknown cause This little bell was an agonizing reminder to re-investigate this unknown cause with all zeal possible Thus, in this difference between the situations of the two divisions was found the explanation of the difference of mortality

During my first term of service, I appealed to the humanity

of this servant of God and without difficulty attained my wish that the priest in the future should go in a roundabout way to the wards, unattended and without the ringing of the bell and without passing through the other wards, so no one was aware of the presence of the priest, outside of the patients actually in the ward. The conditions in the two divisions were made alike on this point, but difference in mortality remained the same

It was alleged that the reason for the great mortality could be found in the fact that the class of patients in the First Division consisted only of unmarried girls from the most deeply submerged strata of society, who earned their living during pregnancy by hard work and whose lives were made up only of misery and need and were under the influences of depressing mental states, who had probably used abortifacients, etc, etc. If this were the cause, then the mortality in the Second Division must be just as great, because the same kind of patients were admitted there

The cause of the greater mortality (p 35) in the First Obstetrical Clinic has been attributed to the fact that the accoucheurs examine more roughly than do the pupil-midwives

Granted that it be so, if the introduction and even the rough introduction of the index-finger into the vagina widened and lengthened by pregnancy, if such a rough examination of the uterine segment accessible through the vagina be such a harmful thing that it may cause such a fearful condition as puerperal fever is, then indeed the passage of the fetal body through the genitals must be just as harmful, so that it cannot be imagined why each birth does not end fatally

The cause for the greater mortality has also been found in the injured modesty of the women delivered in the First Clinic in the presence of men Whoever is familiar with conditions at the Vienna Lying-in Hospital will not doubt that the women in the First Division are indeed harassed by fear, but not by offended modesty, moreover, I cannot conceive how injured modesty can cause an exudative process

That the medical treatment was not to blame for the fact that more women died in the First Clinic is evident, because the medi-

cal treatment in both divisions was identical and from time to time, by way of experiment, all sick puerperae were transferred to the General Hospital, where they succumbed under very different medical treatment. Also, the conditions in both divisions were not such that many became ill in both divisions alike, so that in the First few recovered and many died, while in the Second, many got well and few died, but in the First Division more puerperae became sick and fewer in the Second. The convalescent cases (p. 36) among the sick puerperae were not different in the two divisions

And that the obstetrical treatment, many and rough operations, etc, were not the cause of the frequent morbidity in the First Division, is evident from the fact, that no obstetrical operations were performed on the preponderantly greater number of the sick women, for they were treated according to Boer's principles in both divisions

It was the custom in the First Clinic for the newly delivered patients to get up from the delivery-bed three hours post-partum and to walk along a glass-enclosed passage, heated in winter, to the beds assigned to them for the puerperium. This walk was of considerable distance, especially if they had to walk directly to those wards for puerperae further away from the delivery-room, only the feeble, the ill or those, who had been subjected to operative procedures, were carried

That, again, this nuisance did not elicit the greater mortality is evident, because the same practice was also followed in the Second Clinic, and indeed in a somewhat more injurious manner, because the Second Clinic was divided into two parts by the common ante-room, which was never heated, and consequently all the puerperae, who had beds assigned to them beyond the ante-room, had to pass through it

In the First Clinic, there was a large room for puerperae on the second floor of the building, since one could scarcely require the newly delivered patients to walk up there also, healthy puerperae were required to get up out of bed after the seventh or eighth day, which anyhow was the day of getting out of bed, and to walk up there by way of a glass-enclosed stairway. That this second

removal did not cause the greater mortality (p 37) in the First Clinic, is demonstrated by the fact, that the puerperae very seldom became ill on the seventh or eighth day, and that the same procedure was practised in the Second Division

The wretched ventilation in the First Division, which for the most part even during the winter was accomplished by opening the windows, was also cited as an explanation of the higher mortality in the First Division, though the Second Division was ventilated in just such a fashion

The linen was blamed because it was mixed in the laundry of the contractor with linen from the General Hospital and the fact was overlooked that the Second Division likewise used similar linen

The disadvantageous situation, viz the connection with such a large hospital, such as the Vienna Imperial and Royal General Hospital, is likewise common to both divisions, i.e. they lie so near to one another that they have a common waiting-room, and the architecture is the same in both

The disadvantages of uninterrupted teaching and communicating wards for the sick and well puerperae, the free mingling of the attendants of the sick with those of the healthy puerperae, all were common to both divisions

Neither chilling nor errors in diet can be used for the explanation of the differential in the mortality of the two divisions, because the possibility or impossibility of chilling was the same for both divisions The food was delivered to both divisions by one and the same caterer, the menu was the same in both

Such were the endemic causes, to which was ascribed the greater mortality among the puerperae in the lying-in hospital compared with that of the puerperae outside, (p 38) and therewith, aside from necessary exceptions, of which we will speak later, I am in agreement, but they are not suitable as an explanation of the greater mortality in the First Clinic in contrast with the Second We have certainly shown that these endemic, noxious factors were either present to the same degree in both divisions, and consequently an equivalent mortality must have occurred in both divisions, of if these endemic noxious entities

were dissimilar, then they were present to a greater degree in the Second Division and less so in the First. As a result of these noxious influences, the greater mortality should have prevailed in the Second Clinic and the lesser in the First, in fact, it was just the reverse, in that, as Table No I shows approximately, the mortality in the First Clinic, since it was devoted exclusively to the instruction of medical students in obstetrics, was always considerably greater than in the Second

Since neither the epidemic nor the endemic influences accepted up to the present time explain the preponderant mortality in the First Clinic, we shall attempt to test the remaining factors which have been alleged to cause childbed fever

Recent investigators have indeed accused the conception itself as the most remote factor in producing the puerperal processes, in that the effect of the "Sperma Virile" postulates a series of metamorphoses and stimulates many, in part unknown changes in the blood. I do not consider that I am laboring under any illusion, when I make the assertion that those individuals, who have borne in the Second Clinic, were preceded by a conception also. Then how comes the difference in mortality in the two divisions?

(p 39) Hyperinosis, hydremia, plethora, disturbances brought about by the pregnant uterus, slowing and stagnation of the blood-stream, inopexy, the birth-act itself, the decreased pressure caused by the emptying of the uterus, protracted labor, the wounding of the inner surface of the uterus by the birth-act, imperfect contractions and faulty involution of the uterus during the puerperium, the scanty and decreased secretion and excretion of the lochia, suppression of the milk-secretion, the death of the fetus, the individuality of the puerperae are causes to which one may ascribe much or little influence in the production of puerperal fever, and in both divisions must either be harmful or innocuous alike, and cannot be used for the explanation of such an appalling difference in the mortality ratio of the two divisions

Besides the fact that I could find no explanation for the preponderance of mortality in the First Division, yet other things occurred in the First Clinic, for which an explanation is lacking All parturients, in whom the dilatation period is prolonged, in that it lasts 24, 48 hours and over, almost without exception, became ill, as a rule, either during the course of labor, or in the 24–36 hours after delivery and died of a rapidly progressive childbed fever—Such a slow progress during the period of dilatation was without danger in the Second Clinic

As such slow progress in the first stage occurred as a rule only in primiparae, who perished in this manner, time and time again I have pointed out to my pupils, that these blooming young girls teeming with health, because their period of dilatation was prolonged, would become ill, either during labor itself or shortly after delivery (p 40) of a rapidly progressive puerperal fever. My prognosis was realized, I did not know, to be sure, why this happened, but I saw it happen often, the fact was the more inexplicable because it was not repeated in the Second Division under similar conditions

We speak here, let it be said once again, of the period of dilatation and not of a slowly progressing expulsive period; therefore trauma as a cause is not under consideration. Again, not only these mothers, but even their newborn children, whether male or female, have all died of puerperal fever. I am not the only one who speaks of puerperal fever in the newborn. The anatomical findings in the cadavers of such newborn were, with the exception of the genital organs, identical with findings in the dead bodies of puerperae who succumbed to puerperal fever. To recognize the changes in the bodies of the puerperae and not to recognize the identical results in the bodies of the newborn, invalidates the pathological anatomy.

If it is one and the same disease from which the puerperae and the newborn die, then there must be the same etiology for the newborn which is admitted as applicable to the mothers. Since this same difference in mortality, which we observe among the puerperae of the two clinics, repeats itself among the newborn, i.e. in the First Division, the newborn also die in much larger numbers than in the Second Division, then the hitherto accepted etiology of childbed fever shows itself to be just as deficient in explaining the difference in the mortality among the newborn

from childbed fever as it has been in the explanation of the difference in mortality among the puerperae (p 41) Table XIV shows the difference in mortality among the newborn of the two divisions

Because of the mother's death or inability to nurse, a large number of newborn infants, of whose fate we shall speak later, were sent to the foundling-hospital

The sickening of the newborn by childbed fever may be considered in two ways either the causative factor in childbed fever may work on the mother during the intra-uterine life of the fetus, and the childbed fever is transmitted to the child through the mother, or the causative factor in childbed fever affects the infant

Year		1st Div			2d Div		
rear	Infants	Deaths	%	Infants	Deaths	%	
1841	2813	177	6 2	2252	91	4 4	
1842	3037	279	9 1	2414	113	4 00	
1843	2828	195	6 8	2570	130	5 0	
1844	2917	251	8 6	2739	100	3 0	
1845	3201	260	8 r	3017	97	3 0	
1846	3533	235	6 5	3398	86	2 0	

TABLE XIV

not be affected Consequently the infant dies, not from a child-bed fever transmitted to it, as in the first case, but from a childbed fever originating in its own body. If the childbed fever is transmitted to the infant from the mother during its intra-uterine life, then the difference in mortality among the newborn of the two divisions is not explained by the hitherto accepted etiology of childbed fever, because it is insufficient for the explanation of the illness among the mothers. But if the causative factor for childbed fever works independently of the mother directly upon the infant after labor, then the improbability of explaining the difference in mortality among the newborn of the two divisions by the hitherto accepted etiology of childbed fever remains the same, because the noxious elements are either the same in both divisions, and consequently a like mortality among the newborn

(p 42) should have prevailed in the two divisions, or if the harmful factors are unlike, then they are present in larger numbers in the Second Clinic, there should therefore be a greater mortality in the Second Clinic, but actually the greater mortality prevails among the newborn in the First Clinic

Aside from the foregoing, the many etiologic factors which have been cited as productive of childbed fever among the mothers are impossible of acceptance with reference to the newborn. The newborn were probably unafraid of the First Division because its evil reputation was unknown to them, the injured sense of modesty, because they were born in the presence of men, would be less liable to do harm among the newborn, etc, etc

Childbed fever is defined as a disease peculiar to and occurring exclusively among puerperae, for the genesis of which two things are required, viz, the puerperal state and the causative factor for childbed fever, so that this same cause acting upon an individual during the puerperium produces childbed fever, but the same cause, acting upon another individual not in the puerperal state, does not engender puerperal fever, but another disease make the matter more clear through examples thought that the puerperae in the First Clinic, because they knew what a large contingent the institution gives up to death every year, catch childbed fever from the fear of death, the predisposing cause for them is the puerperal state, and the causative factor for the childbed fever is the fear of death It can be assumed that many soldiers in a bloody conflict are indeed worried by the fear of death, but soldiers get no childbed fever from the fear of death, but other conditions, (p 43) because with them the predisposing cause, namely the puerperal state, is lacking.

The feminine modesty will not only be injured by the fact that they must allow themselves to be used for the public instruction of men, and thus get childbed fever, because they are disposed thereto by the puerperal state, but may indeed be wounded in many other ways. But if the girls so offended are not in the puerperal state, then they themselves, because the predisposing cause is lacking, do not become ill of childbed fever, but are attacked by diverse other conditions, e.g. syncope, etc., etc.

Chilling causes childbed fever in a puerperal, rheumatic fever in a non-puerperal woman. Errors in diet cause childbed fever in a puerperal, but a gastric fever in a non-puerperal woman.

Since one may be convinced that childbed fever may occur not only during the puerperium, but even during labor and during pregnancy itself, then we may put the matter of the puerperium aside and be satisfied with the composition of the blood peculiar to the gravida, but if we apply this definition of childbed fever to the newborn, where do we find the predisposing cause for the puerperal processes in the newborn? In the puerperal condition of their genital organs? Or do they have the composition of the blood peculiar to the pregnant, whether they are male or female? Even the concept itself of puerperal fever is shown to be an erroneous one, through the fact that childbed fever occurs also in the newborn

Because of the great area of the city of Vienna, it frequently happens that parturients on the way to the lying-in hospital are delivered on the street, on the glacis, under the arches of the doorways of houses, wherever the accident befalls them, and then with the newborn carried (p 44) (wrapped) in the apron, must proceed to the lying-in hospital, often in the worst of weather These births are called "Street-births," (Gassengeburten). Admission into the lying-in hospital and reception of the newborn by the foundling-hospital is given gratis under the stipulation that the recent parturients allow themselves to be used for public instruction, and that those who are fit must do duty as wetnurses in the foundling-hospital Babies not born in the lying-in hospital are not admitted gratis into the foundling-hospital, because their mothers have not been used for public instruction. But in order that those who start for the hospital with the intention of being delivered there and cannot reach it before the labor is over may not innocently suffer the loss of this privilege, these street-births are accepted as having taken place in the hospital This practice has led to abuse, in that somewhat well-to-do girls, in order to avoid the unpleasantness of being used for teaching and nevertheless to share in free admission of the baby at the foundling-hospital, are delivered out in the city by midwives and are brought in carriages to the lying-in hospital,

stating that they have been taken unawares by the labor pains on the way. If the infant has not been washed and the stump of the umbilical cord is still fresh, these cases are considered as street-births and the mother admitted to all privileges enjoyed by those delivered in the hospital. The number of the latter is the greater and in both divisions often surpasses the number of one hundred monthly

I have noticed that just those women who have had street-births become ill noticeably less often than those delivered in the hospital, despite the fact that the street-births obviously occur under more unfavorable circumstances than those delivered on our delivery-beds (p 45) It should not be objected that the majority are delivered in bed with the assistance of a midwife, and that our puerperae must seek their beds on foot three hours after delivery, for this walk over a passage-way, glass-enclosed and heated in winter, is certainly less harmful than to be delivered by a midwife, there also to get up soon after labor and to go from God-knows-how-many-floors-up down to a carriage and to travel in every sort of weather over wretched pavement to the hospital and there to mount again to the first floor. To those who are actually delivered in the street this applies to a still greater degree

It seemed logical to me, that the puerperae who have undergone a so-called street delivery should become ill at least as often, if not more frequently, than those delivered in the hospital We have previously expressed our unshakeable conviction that the mortality in the First Clinic is not contingent upon epidemic influences, but that there are endemic, as yet unknown noxious agents, ie harmful things, which manifest their pernicious activity within the limits of the First Clinic What, then, has protected the women delivered outside the lying-in hospital from the destructive effects of the unknown endemic agents active within the First Clinic?

In the Second Division, the state of health among the puerperae who have had street-births was just as favorable as in the First Division, but there it was not extraordinary, because the state of health among the puerperae there was a much more auspicious one in general

Here would be the place to show by a table the smaller per-

centage of fatalities among the street-births in comparison with the births, which occurred in the First Clinic

(p 46) During the time that the records of the First Obstetrical Clinic were at my disposal, I did not realize the need of such a table, because this fact was denied by no one, so I neglected to prepare such a table. Later, when I was no longer an Assistant, the fact was denied, just as it was also denied that there was a significant difference between the mortalities in the First and Second Clinics, which difference is made an undeniable fact by Table No I. In 1848, Prof. Skoda proposed, at an assembly of the Professors of the Vienna Medical Faculty, that the College might nominate a commission to prepare such a table, in addition to other duties.

The motion was accepted by the great majority, the commission was selected at once, but as the result of a protest by the Professor of Obstetrics, the commission dared not begin its activity, due to orders from higher up

Besides the street-births, those puerperae who had premature labors also became ill less frequently than those who delivered at term. The puerperae, after premature deliveries, were not only exposed to the same noxious elements as were those who delivered at term, but to another detrimental factor, i.e. whatever caused the premature delivery. In spite of this fact, how is their better state of health to be explained? The explanation that the more premature the labor is, so much the more the puerperal state is undeveloped, and as a result the disposition to a puerperal disease is less, is nullified by the observation that the puerperal state is certainly not necessary for the genesis of puerperal fever, because puerperal fever can start during labor, yes, even during pregnancy itself and can even be fatal

The better state of health among the puerperae (p 47) after premature delivery in the Second Clinic was in accordance with the better state of health among the puerperae after full term labors in this clinic

The puerperae also became sick sporadically, i.e. a patient became ill and several of her neighbors to the right and left remained healthy, but it happened frequently that whole rows, as they lay next to one another, became ill, without any one among them remaining well. The beds in the lying-in wards are arranged in rows with space between along the length of the room. The wards according to their location have a north and a south or an east and a west wall the long way of the room. If the patients who lay in the beds along the north wall of the ward became ill, we were inclined to attribute to chilling an important role in the etiology of the sickness of these puerperae, but behold during the next occupation of the room by patients, the south row became sick, just as those who lay along the east and sometimes along the west walls became ill, and frequently the disease passed from one side to the other, so that no particular quarter deserved special blame or credit

How was this phenomenon to be explained, since it was not repeated in the Second Clinic, but occurred there only sporadically?

That childbed fever is not a contagious disease and that the disease was not carried from bed to bed by a contagium, we shall express here as our conviction, and we shall produce the proof for it later. For the present, the observation will suffice that, if childbed fever be a contagious disease, (p 48) the sporadic cases of disease among the puerperae in the Second Clinic would be sufficient to make the sporadic case an epidemic among the puerperae, by extension of the Contagium from bed to bed

The executive power of the State did not remain indifferent to this disturbing phenomenon of a greater mortality in the First Clinic in comparison with the Second, and repeatedly created commissions for investigation and discussion, in order to ascertain the cause of the difference in mortality and to see whether the really ill puerperae could not be saved in greater numbers than was the case in the First Clinic. In order to try to solve the latter problem, from time to time all the sick puerperae were transferred to the General Hospital, where nevertheless they died, with few exceptions, although they were subjected to different treatment by other physicians and were in another ward, not merely among those ill with puerperal fever alone, etc., etc.

As causes for the greater mortality, there were blamed by the

appointed commissions first one, then the other, or several of the above mentioned causes, for which the necessary measures were taken, without result, to reduce the mortality to within the limits of that of the Second Obstetrical Clinic

It was proven by the futility of the precautions taken that the etiological factors blamed for the enormous mortality at the First Clinic were not the causes which really produced the greater mortality

Towards the end of the year 1846, there was a predominant opinion among the members of the commission that the sickness among the puerperae was incidental to injury done to the birth-canal by examinations made for the purpose of instruction, but because such examinations are carried on similarly during the instruction of the midwives, there was no doubt that, in order to make the frequency of the sickness in the First Division comprehensible, the medical students and the foreigners in particular should be blamed, since they examined more roughly than did the midwives

On this supposition, the number of students was decreased from 42 to 20. The foreigners were almost wholly excluded and the examinations themselves were reduced to the minimum

The mortality thereafter was strikingly decreased in the months of December, 1846, January, February and March, 1847, but in spite of the measures cited 57 puerperae died in April and 36 in May, and accordingly the groundlessness of the abovementioned impeachments is clear to anyone

For the sake of clarity, we will quote here the report for 1846 and the first five months of 1847 for the First Division [Table XV]

Later on, we shall come back once more to this mortality, which was decreased in December, 1846, and January, February, March, 1847, rising again in April and May

The reports of the commissions appointed to ascertain the cause of the enormous mortality in the First Clinic unanimously permitted the inexplicable contradiction, in that they called the enormous mortality in the First Clinic an epidemic, but according to the concept of an epidemic, did not explain the impossibility

of any remedy, because it did not indeed lie in the power of a commission to change the atmospheric-cosmic-telluric conditions in the city of Vienna What does one do to shorten the course of cholera epidemics and to prevent their occurrence? They laid the blame on one or more of the above-named causes and then did not call it, as should have been done, an endemic, but an epidemic On the whole, the unfortunate confusion of the con-

TABLE XV

	Births	Deaths	%		
1846					
Jan	336	45	13 39		
Feb	293	53	18 08		
Mar	311	48	15 43		
Apr	253	48	18 97		
May	305	41	13 44		
June	266	27	10 15		
July	252	33	13 10		
Aug	216	39	18 05		
Sept	271	39	14 39		
Oct	254	38	14 98		
Nov	² 97	32	10 77		
Dec	298	16	5 37		
(p 50) 1847			Ì		
Jan	311	10	3 21		
Feb	912	6	1 02		
Mar	305	II	3 60		
Apr	312	57	18 27		
May	294	36	12 24		

cepts of an epidemic and of an endemic is the reason why the true cause of childbed fever was so long in being discovered

In advancing the concept of a puerperal epidemic and endemic, one must disregard in its entirety the number of ill and deceased puerperae. The cause, as a result of which the cases of illness and death occur, is conditioned by the concept of an epidemic or an endemic. An epidemic puerperal fever is one which is brought about through (p 51) atmospheric-cosmic-telluric influences and whether one or one hundred patients die is immaterial in the concept of an epidemic. If puerperal fever is produced by an

endemic cause, i.e. a cause, the effect of which is limited to a particular locality, then this is an endemic puerperal fever and again it makes no difference, whether one or one hundred patients become ill. But the commissions, in explaining the mortality, did not consider the causes, which allegedly have produced puerperal fever, but only the number of cases, and because many puerperae became ill and died, it was called an epidemic

Convinced that the greater mortality in the First Clinic originated from a cause, endemic but still unknown, sought for by me in vain, puzzled as to the nature of childbed fever by the illnesses among the newborn, whether male or female, irritated by the observation of phenomena for which I could find no explanation, such as the almost inevitable death as a result of a prolonged stage of dilatation, the failure to become ill of those who had had street-births and premature labors, as an objection to my conviction that the devastations in the First Clinic were to be ascribed to endemic causes, the puerperae in the First Clinic falling sick in rows, the favorable state of health in the Second Clinic in contrast with the First, without being convinced that the staff in the Second were more able or more painstaking in fulfilling their duties than we were, the lack of esteem, which for this reason the attendants show the staff of the First Clinic, produced in me an unhappy frame of mind, which did not make my life an en-(p 52) Everything was uncertain, everything was viable one doubtful, everything was inexplicable, only the enormous number of deaths was an indubitable fact

The reader can form for himself some idea of my perplexity during my first period of service, when I say, that like a drowning man, who grasps at a straw, I gave up the dorsal position, customary in the First Clinic for delivery and introduced the lateral position for no other reason than that it was the common usage in the Second Division, I did not think that the dorsal position was so harmful, that the increased mortality in the First Clinic was due to it, only in the Second the patients were delivered on the side and the state of health was so much the better, therefore in the First Division they should also be delivered on the side, so that everything would be the same as in the Second Division

During the winter 1846-7, I studied English, so that I might spend the time in which I must wait, because Dr Breit, my predecessor, had again taken over the post of Assistant Physician, for the greater part at the great Dublin Lying-in Hospital however, Dr Breit was appointed Professor of Obstetrics at the University of Tubingen, and for that reason I abandoned my plans for the journey and on March 2, 1847, in the company of two friends, I went to Venice to refresh my mind and spirit, which had been so badly effected by the experiences at the lying-in hospital, among the Venetian art treasures

On March 20 of the same year, a few hours after my return to Vienna, with rejuvenated spirits I took over again the post of Assistant Physician in the First Obstetrical Clinic, but was soon overwhelmed by the sad news that (p 53) Professor Kolletschka, whom I revered highly, had died during my absence

The history of his illness was as follows Kolletschka, Professor of Forensic Medicine, frequently participated with his pupils in the performance of medico-legal autopsies, during such an exercise, he was stuck in a finger by a student with a knife which was used during the post-mortem, in which finger I do not recall Professor Kolletschka then became ill with lymphangitis and phlebitis in the same upper extremity and died, during my absence in Venice, of a bilateral pleuritis, pericarditis, peritonitis, and meningitis, and some days before his death a metastasis formed in one eye Still animated by my visit to the Venetian treasure houses of Art, still more agitated by the report of Kolletschka's death, there was forced on my mind with irresistible clarity in this excited state the identity of this disease, of which Kolletschka died, with that from which I had seen so many hundred puerperae die The puerperae died likewise of phlebitis, lymphangitis, peritonitis, pleuritis, pericarditis and meningitis, and metastases were also formed in them

Day and night this picture of Kolletschka's disease pursued me, and with ever increasing determination, I was obliged to acknowledge the identity of the disease, from which Kolletschka died, with that disease of which I saw so many puerperae die

From the identity of the pathological findings in the cadavers of the newborn with the pathological findings in the women, who died from childbed fever, we had concluded earlier and we think rightly, that the newborn died also of childbed fever, or in other words, the newborn died of the same disease as did the puerperae Since we came upon the identical results in (p 54) the pathological findings in Kolletschka as in the puerperae, then the conclusion that Kolletschka died of the same disease, from which I had seen so many hundred puerperae die, likewise was justified The exciting cause of Professor Kolletschka's illness was known, that is to say, the wound produced by the autopsy knife was contaminated at the same time by cadaveric material the wound, but the contamination of the wound by cadaveric material was the cause of death Kolletschka was not the first to die in this fashion I must acknowledge, if Kolletschka's disease and the disease from which I saw so many puerperae die, are identical, then in the puerperae it must be produced by the self-same engendering cause, which produced it in Kolletschka. In Kolletschka, the specific agent was cadaveric particles, which were introduced into his vascular system ask myself the question. Did the cadaveric particles make their way into the vascular systems of the individuals, whom I had seen die of an identical disease? This question I answer in the affirmative

Because of the anatomic trend of the Vienna medical school, the Professors, Assistants and students have frequent opportunity to come in contact with cadavers. That the cadaveric particles clinging to the hands are not entirely removed by the ordinary method of washing the hands with soap, is shown by the cadaveric odor, which the hand retains for a longer or shorter time. During the examination of gravidae, parturients, and puerperae, the hand contaminated by cadaveric particles is brought into contact with the genitals of these individuals, and hence the possibility of absorption, and by means of absorption, introduction of cadaveric particles (p. 55) into the vascular system of these individuals is postulated, and by this means the same disease is produced in these puerperae, which we saw in Kolletschka

If the hypothesis is correct, that the hand-borne cadaveric particles produce the same disease in puerperae, which the cadaveric particles clinging to the knife caused in Kolletschka, then, if by a chemical effect they may be completely destroyed on the hand, and thereby during examinations of gravidae, parturients, and puerperae, whose genitals may be brought directly in contact with the fingers and not with the cadaveric material, this disease can be prevented to the extent that it is dependent upon the effect of cadaveric particles carried by the examining finger. From the first this seemed to me more than likely, since the fact was known to me that decaying organic matter brought in contact with living organisms produced in them a putrefactive process

In order to destroy the cadaveric particles adhering to the hand, although I cannot now recall the date, but about the middle of May, 1847, I began to use "Chlorina liquida," with which I and every student were obliged to wash our hands before making an examination. After some time, I abandoned the "Chlorina liquida," because of its high price and changed to the considerably cheaper chlorinated lime. In May 1847, in the latter half of which the chlorine-washings were introduced, there still died 36 or 12 24%, out of 294 puerperae, in the remaining months of 1847, the mortality among the puerperae in the First Clinic was as follows.

(p 56)	1847	1847			
Month	Births	Deaths	%		
June	268	6	2 38		
July	250 264	3	1 20		
Aug Sept Oct	264	5	1 89		
Sept	262	12	5 23		
Oct	278	11	3 95		
Nov	278 246	11	4 97		
Dec	273	8	2 93		
	1841	56	3 04		

Consequently of the 1841 puerperae cared for during 7 months, 56 died, or 304% In 1846, when the chlorine-washings were

not yet in use, there died 459 puerperae out of 4010 in the First Clinic, or 11 4% In the Second Division during 1846, out of 3754 there died 105 or 27% In 1847, when about the middle of May the chlorine-washings were introduced, there had died in the First Division 176 out of 3490 puerperae, or 50% In the Second Division, 32 died out of 3306 or 0 9% In 1848, when the chlorine-washings were used assiduously throughout the year, 45 puerperae died out of 3556, or 1 27% In the Second Division during this year, 43 died out of the 3219 delivered or 1 33%

TABLE XVI

Month	Births	Deaths	%	
Jan	283	10	3 53	
Feb	291	2	0 68	
Mar	276	0	0 00	
Apr	305	2	0 65	
May	313	3	0 99	
June	264	3	1 13	
July	269	I	o 37	
Aug	261	0	0 00	
Sept	312	3	0 96	
Oct.	299	7	2 34	
Nov	310	9	2 90	
Dec	373	5	1 34	
	3556	45	I 27	

The figures for the individual months of the year 1848 at the First Division were as shown in Table XVI

In 1848, there were two months, March and August, in which not a single puerpera died

In January, 1849, there were 403 births and 9 puerperae died, In February, there were 389 births and 12 puerperae died, 308% March had 406 births and 20 puerperal deaths, or 4 9%

From the 20th of this month, my successor, Dr Carl Braun

began to function as Assistant

We mentioned above that the commission, appointed to investigate the cause of the greater mortality in the First Clinic

in contrast with the Second, blamed first one or the other or several of the endemic causes mentioned above, as that which produced the greater mortality prevailing in the First Clinic In accordance with this, appropriate measures were employed without success in reducing the mortality to within the limits of that in the Second Clinic (p 58) From this failure the conclusion was correctly drawn that the factors, blamed by the commission, were not the ones which really caused the greater mortality in the First Clinic

I have assumed that the cadaveric material adhering to the examining hand of the accoucheur is the cause of the greater mortality in the First Obstetrical Clinic, I have eliminated this factor by the introduction of the chlorine washings. The result was, that the mortality in the First Clinic was confined within the limits of that in the Second, as the above cited figures show. The conclusion, therefore, that the cadaveric particles adhering to the hand had in reality caused the preponderant mortality in the First Clinic, was also a correct one

Since the chlorine washings were brought into use with such striking results, there was not the slightest change made in the conditions in the First Clinic, to which could be ascribed a share in the diminution of the mortality

The system of instruction among the midwifes is so arranged, that neither the instructors nor the pupils have as frequent an opportunity to contaminate their hands with cadaveric particles, as is the case in the training of the physicians, and hence the lesser mortality in the Second Division

The unknown endemic cause, which produced such terrible devastations in the First Clinic, was accordingly found in the cadaveric particles adherent to the hands of the examiners in the First Clinic

In order to destroy the cadaveric matter adhering to the hands, every examiner must wash his hands in a solution of chlorinated lime as soon as he entered the labor room, (p 59) and since the students had no opportunity to pollute their hands anew with cadaveric particles, I considered it sufficient if the students should wash their hands once with the chlorinated lime solution

On account of the large number of deliveries occurring in one year in the First Clinic, only infrequently was there but one parturient in the labor room, and as a rule there were several in labor at once. For the purposes of instruction, all the parturients, as they lay alongside one another, were examined along the rows, and I considered it sufficient to have the hands washed with soapy water in between examinations, I considered that washing with chlorine water between examinations was superfluous, since in the labor room, after the hand had been cleansed of the cadaveric particles clinging to them, it could not be contaminated with them again

In October 1847, there was admitted a parturient suffering from a foully discharging medullary carcinoma of the uterus, to her was assigned as a labor bed the bed at which the visit always began

After the examination of this parturient, we examiners merely washed our hands with soap the result was that II, of the I2 women delivered along with her, died The foul discharge from this medullary carcinoma was not destroyed by the soapy water, the ichor was carried over by the examinations to the other parturients, and so the childbed fever was multiplied

Thus childbed fever is caused not only by cadaveric particles clinging to the hand, but also by ichorous discharges originating in living organisms, for that reason, the hands of the examiner must be cleansed with chlorine water, not only after handling cadavers, but likewise after examining patients, wherein the hands may be contaminated by ichor, (p 60) before proceeding to the examination of a second individual

The rule developed from this sad experience we observed subsequently, and childbed fever was no longer spread by the transfer of ichor from one patient to another by the examining fingers

The carrier of cadaveric particles and ichorous discharge, by which childbed fever was produced in the First Clinic, was the examining finger

A new tragic experience convinced us that the atmospheric air could also be the carrier of the decomposed organic matter, which engenders childbed fever, in November of the same year,

a patient with a discharging carious left knee-joint was admitted, her genital organs were completely healthy, so the finger which examined her, remained harmless to the other patients. But the ichorous exhalations of the carious knee-joint were so considerable, that the air of the lying-in ward, in which this patient was spending her puerperium, was permeated by it to such a high degree, that childbed fever flared up among the puerperae in the ward and nearly all of the women then in the ward died. The reports of the First Clinic for the month of November were it and for December, 8 deaths, which were for the greater part caused by the ichorous exhalations of the patient mentioned just now.

The atmospheric air of the lying-in ward, permeated by the ichorous particles, penetrated through the genitals, gaping after labor, into the uterine cavity, where the ichorous particles were absorbed and produced childbed fever thereby. Afterwards, similar tragedies were avoided by the isolation of such individuals

(p 61) The lying-in hospital in Vienna was opened August 16, 1784 In the last century and in the first decade of the present century, when medicine, still indulging in theoretical speculation, got along without anatomical principles, there died in 1822, out of 3066 admissions, 26 puerperae, 1 e 0 84% In 1841, when the anatomic trend formed the essence of the Vienna medical school, out of 3035 admissions there died 237 puerperae, or 7 7% In 1843, 274 died out of 3060, or 8 9% In 1827, there died 55 puerperae out of 3294 admitted, or 1 66% In 1842, there were 3287 admissions with 518 deaths, or 15 8%

From 1784 to 1823, there were 25 years, in which died less than 1% of the puerperae cared for in the lying-in hospital, as Table No XVII shows

(p 63) This table is incontestable evidence for my opinion, that childbed fever is caused by transmission of decomposed animal-organic matter

At the time, when the opportunity for transmission of decomposed animal-organic matter was limited by virtue of the system of teaching, the state of health among the puerperae in the lying-in hospital was a favorable one

At the time when the Vienna medical school embraced the

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anatomic trend, then began the unfavorable state of health among the puerperae under treatment in the lying-in hospital When

(p 62) TABLE XVII

Statement of the Imperial and Royal Lying-in Hospital from 16 August, 1784

Year	Patients	Deaths	%	Year	Patients	Deaths	%
1874	284	6	2 11	1817	2735	25	0 91
1785	899	13	I 44	1818	2568	56	2 18
1786	1151	5	0 43	1819	3089	154	4 98
1787	1407	5	0 35	1820	2998	75	2 50
1788	1425	5	0 35	1821	3294	55	1 66
1789	1246	7	0 56	1822	3066	26	0 84
1790	1326	10	0 75	1823	2872	214	7 45
1791	1395	8	0 57	1824	2911	144	4 94
1792	1574	14	0 89	1825	2594	229	4 82
1793	1684	44	2 61	1826	2359	192	8 12
1794	1768	7	0 39	1827	2367	51	2 15
1795	1798	38	2 11	1828	2833	101	3 56
1796	1904	22	1 16	1829	3012	140	4 64
1797	2012	5	0 24	1830	2797	III	3 97
1798	2046	5	0 24	1831	3353	222	6 62
1799	2067	20	0 96	1832	3331	105	3 15
1800	2070	41	1 98	1833	3907	205	5 25
1801	2106	17	0 80	1834	4218	355	8 41
1802	2346	9	0 38	1835	4040	227	5 61
1803	2215	16	0 72	1836	4144	331	7 98
1804	2022	8	0 39	1837	4363	375	8 59
1805	2112	9	0 40	1838	4560	179	3 92
1806	1875	13	0 73	1839	499 ²	248	4 96
1807	925	6	0 64	1840	5166	328	6 44
1808	855	7	0 81	1841	5454	330	6 05
1809	912	13	I 42	1842	6024	730	12 11
1810	744	6	0 80	1843	5914	457	7 72
1811	1050	20	1 90	1844	6244	336	5 38
1812	1419	9	0 63	1845	6756	313	4 63
1813	1945	21	1 08	1846	7027	567	8 06
1814	2062	66	3 20	1847	7039	210	2 98
1815	2591	19	o 73	1848	7095	91	1 28
1816	2410	12	0 49		1		

the number of births and the number of medical students and pupil-midwives increased to such an extent that it was too much

for one Professor to oversee the deliveries and to instruct this large number of students and midwives, the lying-in hospital was divided into two sections, and to each division an equal number of medical students and midwives was assigned. On October 10, 1840, by virtue of an Imperial decree, all the medical students were assigned for the purposes of instruction to one division (the First), and all pupil-midwives were assigned to the other division (the Second)

In what year the actual separation of the lying-in hospital into two divisions occurred, I am not in a position to state Tradition has it, and colleagues who took obstetrical training in the Second Division at a time when medical students were still admitted maintain that, at that time, the mortality rate varied between the two divisions, the constantly unfavorable state of health among the puerperae in the First Division dates first from the year 1840, when all medical students were assigned to the First and all pupil-midwives to the Second Division.

After what has been said previously, it would be superfluous

to give an explanation of this phenomenon

(p 64) Table No I shows the difference in mortality among the puerperae of the two divisions, since the First was devoted exclusively to the instruction of medical students and the Second to the instruction of pupil-midwives

Here would be the place to make public a similar table for the year, in which students and midwives were assigned in equal numbers to each division, in order to show that during this period, the mortality in the First Division was not constantly the greater But the necessary data are not at my disposal

Three copies of the report for the two obstetrical divisions were prepared, one report remained in the obstetrical department, one went to the hospital administration, and one to the government. Those who have these reports in their custody would render a service to Science if they would publish them

Only for the year 1840, when the separation of the students and midwives took place, and for the preceding year, do I have the

reports of both divisions

First	Division	
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Year	Births	Deaths	Percent
1839	2781	151	5 4
1840	2889	267	9 5
	Second	Division	
1839	2010	91	4 5
1840	2073	55	2 6

The variations in the mortality, as such occurred in each of the two divisions, can (p 65) be ascribed to the activities of the physicians attending these two divisions.

I was prevented from publishing these data, because, at the time I was compiling them, it was regarded as a denunciation

Professor Skoda had placed before the previously mentioned commission from the Vienna medical professorial college another proposition it was a table, in which, as far as the data went, the number of deliveries and deaths were given for each month, and a list was prepared of the Assistants and the students in the order in which they had served and practiced in the lying-in hospital.

Since Professor Rokitansky had been in office from 1828 at the anatomico-pathologic institute, a list could have been assembled partly from memory and partly from the autopsy protocols, as well as by questioning other physicians, of those Assistants and students, who handled cadavers, and it would have shown, whether the number of cases of illness had any connection with the exercises of the Assistants and students in the autopsy room Because of orders from higher up as previously stated, the commission dared not discharge their duty

Because of my convictions, I must here confess that God only knows the number of patients that have gone prematurely to their graves by my fault. I have handled cadavers extensively, more than most accoucheurs. If I say the same of another physician, it is only to bring to light a truth, which was unknown for many centuries with direful results for the human race. As painful and depressing, indeed, as such an acknowledgment is, still the remedy does not lie in concealment and this misfortune should not persist forever, for the truth must be made known to all concerned

After it became evident that the preponderance of mortality in the First Clinic in contrast with the Second was to be sought in the cadaveric and ichorous particles, with which the hands of the examiners were contaminated, the previously inexplicable phenomena, which took place in the First Division, could be very easily explained In the morning, the Professor, and in the afternoon, the Assistant, daily made a general visit accompanied by the students, during which all the parturients and gravidae present were examined by the students for the purposes of instruction Before the Professor's morning visit, the Assistant must examine all the parturients so as to be able to report to the Professor the meanwhile, the Assistant, as time and circumstances permitted, conducted the examinations along with the students, if, therefore, a parturient, because of a prolonged state of dilatation had spent one or more days in the labor-room, then she certainly was examined repeatedly by hands contaminated by cadaveric and ichorous particles, and in this manner she was given childbed fever and for this reason these women, as we have stated previously, died almost without exception

Afterwards, when examinations were made with clean hands as the result of the chlorine washings, the deaths ceased among those patients who had a prolonged first stage and the protracted first stage became as little dangerous, as it had been previously in the Second Division

In order to make clear what we say now, we shall partially outline the concept of childbed fever as we see it

The first principle is the absorption of a decomposed animal-organic substance, as a result of this absorption there is brought about a change in the composition of the blood (disintegration), (p 67) for our present purpose, enough has been said on this point. Previously, we have declared that those, in whom the dilatation period is prolonged, become ill either during or immediately after labor of a rapidly progressive childbed fever, i.e., in other words, the absorption of the decomposed animal-organic matter, and the change in the composition of the blood resulting from it, occurs at a time during which the fetal blood is in organic communication with the maternal blood-stream, as a result the change in the composition of the blood, from which the mother

suffers, is transmitted to the infant As a result, we see the newborn, male or female, die in the First Clinic from a disease identical with that of the mother, and in addition, just as frequently as do the mothers in the First Clinic and more frequently than do the newborn in the Second Clinic In the mothers, the childbed fever, as has been said, is caused by the absorption of decomposed animal-organic matter, upon which the change in composition of the blood depends, in the newborn, the affair occurs somewhat differently If the infant, yet unborn inside the genital organs, is contaminated during the examination by a finger infected by cadaveric particles, the contaminated part of the fetus does not absorb this decomposed animal-organic matter, and therefore childbed fever in the newborn is not caused by the absorption of a decomposed animal-organic matter, but by the fact that its blood comes in organic contact through the placenta with the maternal blood already polluted as a result of the absorption of a decomposed animal-organic matter.

Therefore it must be made plain, that no infant has ever died from childbed fever while the mother remained healthy, because childbed fever never occurs in the newborn independently by absorption. The newborn (p. 68) always becomes ill from childbed fever only if it is communicated to it by way of the mother's blood, both fall sick if the infant is still in organic communication with the mother by way of the placenta and the maternal blood has already undergone disintegration as a result of the absorption of a decomposed animal-organic matter. The mother can become ill by herself from childbed fever, the child can remain healthy under the assumption that the organic communication between mother and child is interrupted at a time during labor, when disintegration of the maternal blood has not yet set in as a result of the absorption of decomposed animal-organic matter

As a result of the chlorine washings, as stated, the cadaveric particles clinging to the hands of the examiner were destroyed and consequently the morbidity among the puerperae was confined to the limits of that in the Second Clinic We saw the same condition occur among the newborn, for their mortality also decreased Healthy mothers cannot communicate childbed fever to the newborn

Without the chlorine washing, in 1846 in the First Clinic 235 out of 3533 infants died, or 6%

In the Second Clinic 86 out of 3398 infants died, or 25% In 1847, during the last seven months of which the chlorine washings were practiced, 167 out of 3322 babies, or 502%, died at the First Clinic In the Second Clinic, 90 out of 3139 infants died, or 28%

In 1848, when chlorine washings were practiced throughout the year, 147 out of 3496 infants, or 42%, died at the First Clinic

At the Second Clinic, there died 100 out of 3089 infants, or 32%

(p 69) The deaths among the newborn were not caused by childbed fever

If the mother died before her infant, or if the mother for any reason could not nurse her baby, it was sent to the foundling-asylum, and numerous deaths from childbed fever occurred among the nurslings in the foundling-asylum

After the introduction of the chlorine washings, the deaths from childbed fever among the nurslings in the foundling-asylum ceased Dr Bednar, at that time acting Chief Physician of the Imperial and Royal Foundling-asylum in Vienna says in his book, "Diseases of the Newborn and Nurslings, Studied from the Clinical and Anatomico-pathological Standpoints," Vienna, 1850, Gerold, p. 198. "The sepsis of the blood among the newborn has now become a great rarity, for which we have to thank the discovery, far-reaching and worthy of the greatest consideration, of Dr Semmelweis, Emeritus Assistant of the First Vienna Obstetrical Clinic, who fortunately has found the cause and means of prevention of this murderously raging puerperal fever"

What we called "childbed fever" in the newborn, in order to retain the then customary mode of speech, Dr Bednar more correctly designates "sepsis of the blood"

After we had found the etiologic factor of the preponderance of mortality in the First Clinic, in contrast with the Second, in the cadaveric particles clinging to the hands of the examiner, the explanation was easily given for the strikingly rare cases of illness among the street-births in contrast with the other patients de-

livered by us Those delivered on the street, because the baby was already born and as a rule the placenta was also expelled, were not examined further for the purposes of instruction, and a lying-in bed was assigned to them, which as a rule they quitted in good health, no fingers, contaminated with cadaveric particles, were brought into contact with their genitals (p 70) and therefore no childbed fever appeared among them

The puerperae, who had had premature labors, also rarely became ill, because they were not examined

The first indication in a premature labor was to retard the labor whenever possible As a result of this indication, such patients were not used for public instruction, and thus their genitals were not contaminated by decomposed organic matter

Likewise, the cases falling sick in rows now find an easy ex-Because of the great number of deliveries which took place in the First Clinic, frequently there were many patients present as parturients at the same time as parturients in the laborroom, and twice daily, at least during the visit of the Professor in the morning and the visit of the Assistant in the afternoon, the parturients present in the labor room were all examined in turn, for teaching purposes, as they lay next to one another in the labor Consequently if they were examined by hands defiled with cadaveric particles, the genitals of many patients were contaminated at the same time by cadaveric particles, and by this means, the seed was planted at the same time in many individuals for the genesis of childbed fever during the puerperium puerperae lay in rows in the lying-in wards, in the order in which they were delivered, thus it happened that those present in the labor-room were delivered so nearly at the same time, that they lay in the lying-in beds in much the same order in which they lay upon the labor-beds, since the seed was planted on the laborbed for future cases of puerperal fever in rows by hands defiled by cadaveric particles, childbed fever must therefore break out in rows along the lying-in beds

(p 71) After the introduction of the chlorine washings, no more cases of illness broke out among the puerperae in rows

We have stated above, that towards the end of the year 1846,

because of the prevalence of childbed fever in the First Clinic, I know not how many commissions were instituted to ascertain the cause of this mortality. We have reported that the commission found the cause of the disease in the First Clinic in the injury to the genitals brought about by the examinations carried out for the purposes of instruction. But since such examinations were also made during the instruction of the pupil-midwives, the Commission had no hesitation in explaining that the medical students, and especially the foreigners, were too rough in their examinations. On this assumption, the number of students was reduced from 42 to 20, the foreigners were almost entirely excluded, only two were allowed among the students and the examinations were themselves reduced to a minimum

Table No XV shows how great the mortality was before the adoption of this measure, how it diminished in consequence of it, and how the mortality significantly increased in spite of it again in the months of April and May

Here is the place to give an explanation of this phenomenon, but before we give this explanation, it is necessary to make some things clear

On account of my situation as candidate for the Assistantship in the First Clinic, later as provisional and finally as actual Assistant in this clinic, I was not able to study gynecology, which is so necessary for an accoucheur, in the gynecological division of the Imperial and Royal General Hospital As a substitute therefore, from the day when I decided to devote my life to midwifery, i.e. from 1844 to my removal to Pest in 1850, I was accustomed, before the morning visit of the Professor, to examine for the benefit of my gynecological studies almost every day all the female bodies in the dead-house of the Imperial and Royal General Hospital The kindness of Professor Rokitansky, of whose friendship I could boast, gave the opportunity to dissect all the female cadavers, which were not already set aside especially for autopsy, so that I could check the results of my examinations by the results of the dissections

For reasons, which need not be given here, the Assistant in the First Clinic during the months of December 1846, and

January, February and March 1847 visited the morgue only very seldom. The native students, whose number was limited to 18, had followed his example, and thus the opportunity for polluting the hands with cadaveric particles was considerably diminished. Through the reduction of the examinations to the minimum, the opportunity for polluting the hands with cadaveric particles was considerably diminished. Through the reduction of the examinations to the minimum, the opportunity for bringing hands defiled with cadaveric particles in contact with the genitals of the patients was likewise diminished, and thus the reduction in the mortality in the First Clinic during the above-named months is explained

On March 20, 1847, I took over for the second time the post of actual Assistant in the First Clinic, I made my gynecological studies in the dead-house during the early morning, then went to the labor-room to examine all the parturients, as it was my duty and that of my predecessor, so that I could then make a report on each individual parturient to the Professor making his morning visit Thus I brought my fingers polluted with cadaveric particles into contact with the genitals of a great many parturients, and the result was that in April, out of 312 women delivered, (p 73) 57 or 18 26% died In May, out of 294 women delivered 36, or 12 24%, died It was about the middle of May, I cannot recall the day exactly, that I introduced the chlorine washings It was therefore not the injury done to the genitals by the rough examinations of the students, in itself an erroneous assumption, but the contamination of genitals with cadaveric particles by means of the examining finger, which caused the greater mortality During the months of April and May, when in the First Clinic again so many died, the conditions in the First Clinic were the same as in December, 1846, January, February and March, 1847, and yet the mortality was considerably greater because my fingers contaminated with cadaveric particles intervened

After the fortunate results of the chlorine washings over quite a long period of time, the number of students was increased again to 42, and no distinction was made between natives and foreigners. The examinations were resumed once more to the extent

that was necessary for instruction, and nevertheless the First Clinic lost the dismal distinction of a greater mortality over the It may not be objected, that I also acted as provisional Assistant in December 1846, January, February and March 1847, and had made my gynecological studies in the dead-house, and in spite of that, the mortality was considerably lessened, the explanation lies in the fact, that I had the right, but not the duty, to examine all the women in labor After a stay of three years in such a large lying-in hospital, naturally it was not instructive for me to examine every single parturient, I examined only the exceptional labor case, i.e. very seldom. As soon as I became the actual Assistant again, (p 74) I was required to examine each patient before the morning rounds for my report to the Professor, during the time remaining, I had to examine almost every case again for the instruction of the students, and hence the large mortality in April and May of the year 1847

Among the native-born students, there were included those students who had studied in an Austrian university, and among the foreigners were included those who had completed their studies at a university outside of Austria, and for their further education had attended the magnificent institutions of the University of Vienna for a longer or shorter period of time Vienna, one can find physicians from all countries of the civilized The course in practical midwifery lasted two months, the congestion of students in this greatest midwifery hospital of the world was so great, that it was impossible to accept all applicants at the same time, without seriously annoying the parturients Each applicant received a number, and the vacancies were filled without distinction between native and foreigner, according to the order of the numbers Each student was free to attend the course in practical midwifery, as often as he considered it necessary for his obstetrical training, but in order that the others might not be kept out by the uninterrupted attendance of many students over several courses, three months had to elapse between each two courses The commission accused the foreigners of being more dangerous than the natives, because they examined more roughly, and as a result of this assumption, only

two foreigners were permitted to attend the course in practical midwifery. Since the commission made such a groundless accusation against the foreigners, anyone might think even without a protest on my part, that I myself considered the foreigners as more dangerous than the natives. I did, but not for the reason that they examined more roughly (p. 75) The reason for the greater dangerousness of the foreigners in contrast with the natives lies in the following circumstance.

The foreigners come to Vienna, in order to complete a medical education already obtained in other universities They attend the pathologic and forensic courses in the General Hospital, they take courses in pathologic anatomy, operative instruction on the cadaver in surgery, obstetrics, and ophthalmology, they visit the medical and surgical wards, etc., in a word, they spend their time as efficiently and as profitably as possible, but in this way they have manifold opportunities to contaminate their hands with decomposed animal-organic matter, and therefore it is not surprising that the foreigners, busy at the same time in the lying-in hospital, were dangerous for the patients The natives were accustomed to attend the practical course in midwifery after passing two stiff examinations towards the degree of Doctor of Medicine The law requires six months as the shortest time for preparation for these examinations, therefore the native students had already undergone a great deal of worry before their admission into the lying-in hospital They considered the time spent during the obstetrical course more as a rest period and during this course were not busy with other subjects to the extent that they had the opportunity to pollute their hands as did the foreigners, and indeed during their stay in the lying-in hospital they were much less busy with the other branches of Medicine, because after completion of the practical course in Midwifery they have the opportunity to perfect themselves in Medicine, as completely as is possible in the schools of the University of The foreigners were compelled, since their stay in Vienna as a rule lasted only for a few months, to take several subjects in the medical course simultaneously For that reason one need cast as little reproach on the foreigners (p 76) as do I

and on all those, who, not knowing the danger of examining with hands redolent with cadaveric particles, thereby caused so many deaths

In order to submit my theory to a direct test, I considered that animal experiments were necessary, which I performed on rabbits along with my friend, Dr Lautner, assistant to Professor Rokitansky

First Experiment On March 22 of this year, a brush moistened with discolored exudate from a case of endometritis was introduced into the vagina and uterine cavity of a female rabbit 15 minutes after delivery

The animal was apparently well from that time until April 24, when it was found dead

Autopsy The wrinkled mucous membrane of the uterine horns overlaid with fluid dirty grayish-red exudate, in the left chest cavity some fluid, the lower lobe of the left lung covered with a membranous, congealed, pale yellow layer of exudate, its parenchyma, as well as that of the posterior lower third of the upper lobe, gray-hepatized, the remaining portion of this lung as well as the right lung aerated and cinnabar-red. The heart enveloped in a pale, yellow, softly villous layer of exudate and here and there a few drops of fluid exudate

Second Experiment On April 12, a female some 12 hours after delivering five young, was treated as in the first experiment Because the animal of the first experiment appeared to be entirely well, it was thought that, in the second experiment, the brush should be introduced several days in succession. On April 14, the animal manifested pain during the introduction of the brush, the uterus contracted forcibly and expressed a yellowish-white, thick fluid exudate. On April 17, the animal appeared to be quite ill, on April 22, a diarrhea appeared and on April 23 it was found (p. 77) dead. The introduction of the brush was carried out once daily until death.

Autopsy In the abdominal cavity, a somewhat membranous, coagulated exudate, causing adhesions between separate intestinal coils, on the vaginal and uterine mucous membrane, and in their tissues, a yellowish, stiff exudate, the uterine horns

moderately distended, filled with dirty grayish-red exudate, in the large bowel several groups of ulcerating follicles, the mucous membrane ulcerated partly in lentil-sized areas, partly infiltrated with yellow exudate, and each of these areas surrounded by an injected vascular area. The lungs light cinnabar-red, in the upper left lobe a bean-sized, thick area infiltrated with blood and with a purulent spot in the center.

Third Experiment On April 15, the brush was introduced into a female for the first time some 10 hours after the delivery of four young, and then once daily until death, which occurred on April 21 On April 17 the animal manifested pain during the introduction of the brush and expressed a purulent exudate from the uterus On April 20 diarrhea appeared

Autopsy In the abdominal cavity, a moderate quantity of fluid and membranous, clotted exudate binding together separate coils of intestine. The mucous membrane of the vagina and of the uterus were covered and infiltrated with a yellow, closely-adherent exudate. The uterine horns extremely distended, filled with grayish-red, dirty exudate. In the liver, several areas ranging up to lentil-sized, infiltrated with purulent exudate, on the mucous membrane of the large intestine, near the terminal portion of the Processus Vermiformis, a larger-than-lentil-sized area, surrounded by an injected vascular area, ulcerated and covered over with pale yellow exudate.

Fourth Experiment On May 24, there was introduced into a robust female about an hour after the cast of five young, a brush, which had been dipped in the blood, diluted with water, from the body of a man dead 36 hours before from marasmus On the 25th, (p 78) the brush before introduction was moistened with pleuritic exudate on the 26th with peritoneal exudate of a tuberculous case, the same on the 27th From then on the brush was not introduced The animal remained apparently completely healthy and cast for the second time on June 24

Fifth Experiment On June 2, a brush, moistened with peritoneal exudate already used in the fourth experiment, was introduced into a female some 12 hours after the cast On June 3, 4 and 5, the introduction was repeated and from then on the

animal was left unmolested It remained apparently sound and cast again on June 28 On June 29, the brush moistened with pleuritic exudate was again introduced, likewise on June 30. The animal remained healthy and on July 17 was killed because of another experiment. The autopsy showed no changes indicating pyemia.

Sixth Experiment On June 10, a brush moistened with a purulent pleuritic exudate from a male cadaver was introduced into a female some hours after the cast

From June 11 to 30, the peritoneal exudate of a man dead of typhus was used for the moistening of the brush The animal remained healthy and cast for the second time on July 15

On this day, the brush was again introduced, and from then on daily up to July 24 The animal became emaciated, had a diarrhea and was found dead on July 25

Autopsy In the pericardial sac, some drops of flocculent serum On the tricuspid valve, a pea-sized vegetation, penetrating into the Conus Arteriosus, and a hempseed-sized vegetation, resting upon the free edge of the valve leaflet, closely adhering to the endocardium of the papillary muscle, dirty white, unevently dentated and matted, the inner surface of the right ventricle covered with discrete, yellowish-white, tubercular coagula. In the (p 79) abdominal cavity, a clotted membranous and fluid exudate. In the periphery of the liver, and particularly on the under-surface, a pea-sized area infiltrated with stiff, yellowish exudate. The uterus was as described in No 4, only the infiltration and necrosis more marked. Several veins of considerable thickness between the corpus uteri and the right uterine horn closely packed with stiff yellow exudate.

Seventh Experiment On June 16, some hours after the cast The brush was moistened with pus from an intercostal abscess, which was found in the body of a patient dead of cholera

The implantation was done daily up to July 3 The animal remained sound and cast for the second time on July 18

The experiment was now so modified that a brush was no longer used, to avoid mechanical injury A gonorrhea-syringe with a nozzle three inches long was introduced into the genital canal

Immediately after the injection, the animal again expelled the fluid. The injection was done once daily up to July 24. The animal became emaciated and was found dead on July 29.

Autopsy In both thoracic cavities some yellow, thick, fluid exudate, in the abdominal cavity about two ounces of partly membranous, clotted exudate, the uterus normal, pale, no exudate on its mucous surface

Eighth Experiment On June 24, the same animal, which was used for the fourth experiment The implantation was done daily from June 24 to July 8. The animal became badly emaciated, diarrhea appeared and it was found dead on July 25

Autopsy In the abdominal cavity, some yellow exudate, on the posterior uterine wall, a thin layer of dirty-yellow, tightly adherent exudate, in the uterine horns, some fluid, dirty-grayish-red exudate, on the (p 80) boundary between vagina and uterus, corresponding to the attachment of the urethra a bean-sized, superficially necrotic area infiltrated with purulent exudate, the ulcer thus formed with jagged, undermined edges, the base covered with a layer of exudate and the wall of the vagina infiltrated for the distance of an inch with a line-thick exudate

Ninth Experiment On August 8, some hours after the cast, peritoneal exudate from a man was injected. The animal expelled the injection immediately. The injection was made daily until the 15th. The animal on the 13th appeared ill and was emaciated. On the 20th, it was found dead

Autopsy Some flocculent exudate in the abdominal cavity, in the periphery of the liver, numerous, mostly hempseed-sized, yellow foci of inflammation. The uterine mucosa excoriated on the posterior wall for the distance of a line. The wall infiltrated with yellow exudate out to the peritoneum, the excoriation lay about 1 inch higher than in No 6 and 8. The right uterine horn infiltrated with exudate to such an extent, that it was enlarged to twice its volume, free exudate on its mucous surface, the veins in both broad ligaments distended with exudate

It is hardly necessary to state that the changes found in the rabbit cadavers are the same as appear in human bodies as a result of puerperal diseases and in general following pyemia

As the end of my two-year service drew near, I requested that my period of service be increased two years also, as had been done for my predecessor, Dr Breit, and of course, I thought that I was bound even more to request it, as I would thus have the opportunity to be able to confirm my views on the origin of child-bed fever, which raised so many contradictions, by a study of two years longer, but my petition was in vain, (p 81) even though this favor was given to my colleagues serving in the Second Division

Even my successor received a two-year increase of service After my retirement on March 20, 1849, from the post of Assistant, I requested a Privat-Docenture in Midwifery My petition was without success

After I had applied for a second time, I was appointed after an eight-months' wait on October 10, 1850, as Privat-Docent for Theoretic Midwifery, limited, however, to demonstrations and exercises on the phantom

Such a limited docenture would be of no benefit to me, since the statue requires for the validity of the certificature by the Docent just as broad an instruction on the part of the Docent, as that of the Professor, but it was permissible for the Professor to give demonstrations and exercises on the cadaver

In October, 1850, I removed to my native city, Pest

I spent one of my first evenings in Pest in the company of a large number of physicians Because of my presence, the discussion turned upon childbed fever, and it was urged in vindication of the objections against my theory, that in the lying-in division of the St Rochus Hospital in Pest, even then as all through the year, a furious epidemic of puerperal fever was raging, although there were no examinations made by students, whose hands were polluted by decomposed animal-organic matter, because the obstetrical department in the St Rochus Hospital was not used for teaching

The next morning, in order to see the situation with my own eyes, I went to this lying-in hospital and found a (p 82) puerpera dead just then of puerperal fever, the body not yet removed, another moribund and four others seriously ill with puerperal

fever, the other patients present were not puerperae, but suffering from other diseases. Thus was established the actuality of an unfavorable state of health among the puerperae, not in contradiction to, but in harmonious corroboration of my theory of the origin of puerperal fever, because closer inquiries showed that the obstetrical division was not a separate department, but was assigned to the surgical division and the chief accoucheur was at the same time chief surgeon and coroner. In addition, because of the lack of prosectors, the autopsies must be done by the physicians of the respective departments

The chief was accustomed to make rounds in the surgical division first, then in the obstetrical department, while no examinations were made by students, whose hands were defiled by decomposed animal-organic matter, in the obstetrical division of the St Rochus Hospital, yet the chief and the physicians assigned to him made examinations after they had previously contaminated their hands with decomposed organic matter during their visits to the surgical department

We have previously shown that the greater mortality in the First Clinic in contrast with the Second was due to the cadaveric material, which clings to the hands of the examiner. We have pointed out, that in October, 1847, ichorous particles from a discharging medullary carcinoma of the uterus had caused childbed fever. We have shown that in November, 1847, ichorous particles from an odorous carious knee had caused childbed fever.

In the obstetrical division of the St Rochus Hospital, (p 83) the exciting factor for childbed fever was the different decomposed animal-organic substances, which are found so abundantly in a surgical department. It is necessary to say some words here on the conditions in the obstetrical division in the St Rochus Hospital

This hospital belongs to the municipality of Pest and has a capacity of 600 patients. There are assigned three medical and two surgical chiefs. The obstetrical department, as already stated, is assigned to a surgical chief. As long as the obstetrical clinic of the Pest medical faculty is open, no parturients may be accepted at St. Rochus Hospital, in order not to withdraw ma-

terial for teaching from the clinic, and only during the long vacation in August and September, during which the obstetrical clinic of the Pest medical faculty is closed, are parturients accepted at the St Rochus Hospital, while for the remaining ten months of the year the space of the obstetrical department is used by the surgical division

During the school-year, only those individuals were delivered in the obstetrical department, who were overtaken by labor-pains whilst under treatment for various diseases in the hospital. The space allotted to the obstetrical department was located on two different floors of the building and was composed of one labor-room and two lying-in wards, whose six windows opened upon the morgue. Along the ground-floor of the morgue extended a broad street, which gave relief to the noxious odors of the morgue.

On May 20, 1851, I took over the obstetrical department of the St Rochus Hospital as an unpaid honorary chief and functioned as such for six years until June, 1857, and thus the connection with the surgical division (p 84) was broken and during the school-year the space of the obstetrical department was used, not for surgery, but as a gynecological department. Through this, the exciting cause of childbed fever formerly prevalent in this department was done away with, i.e. the decomposed animal-organic matter from the surgical department, as a result, childbed fever did not appear to any great extent

We did not ordinarily put into practice the chlorine washings, because we did not have to cleanse our hands from decomposed animal-organic matter

Only after the few autopsies, which we had to do, did we use the chloride of lime to cleanse our hands

In the vacation-months of the school-year 1850-1, there occurred 121 births in the obstetrical department of St Rochus Hospital, for 1851-2, 189 births, for 1852-3, 142 births, for 1853-4, 156 births, for 1854-5, 199 births, and for 1855-6, 126 births

Thus during these vacation periods, there occurred 933 births, with 24 deaths, and actually from childbed fever, 8, or 085%. The other 16 puerperae died from the different diseases, for which

they were being treated during pregnancy and were transferred to the obstetrical department at the onset of labor

In one of the eight puerperae, who died of childbed fever, the childbed fever was due to the fact that she was examined on account of a breech-presentation by a surgical assistant, after he had just done an autopsy on a man dead from a gangrenous lower thigh. Thus, there died in the obstetrical department (p. 85) of St. Rochus Hospital less than 1% of the puerperae from childbed fever during the six years, where previously childbed fever had exacted so many victims.

On July 18, 1855, I was appointed Professor of Theoretical and Practical Obstetrics in the University at Pest and began my duties as such at the obstetrical clinic in October of the same year The obstetrical clinic was on the second floor of the faculty building and consisted of one delivery room and four lying-in wards

In order to acquaint the reader with the conditions in this clinic, it will answer the purpose to quote in part the petition, which I addressed to the proper authorities, in order to secure permission to abandon these quarters, highly unsuitable as far as sanitary requirements and space are concerned

Among other things in this petition, it says "That the location of the obstetrical clinic is greatly inimical to sanitary requirements, follows from the following considerations

"According to the Royal decree on the organization of the hospital in relation to the area of bed-space, 4 square fathoms were prescribed for each lying-in bed. Inasmuch as the obstetrical clinic has 26 beds, in order to comply with the Royal demands, there must be available 104 square fathoms, but the clinic has only 41 square fathoms, hence it lacks the space required for so large a number of medical students and pupil-midwives. Three rooms are so small, that they can scarcely hold half of the medical students and pupil midwives, but that even in the two rooms which are large enough to hold all the pupils without packing them immovably together, the air therein is to an extent greatly detrimental to the puerperae present there, is evident to anyone who is unprejudiced

(p 86) "In the walls of two wards are three chimneys of the

chemical laboratory, and if there are fires in the corresponding hearths, the temperature of these two wards rises to an unbearable degree

"The space of the clinic is so limited, that no room may be reserved as a sick-ward, consequently, the sick remain scattered among the healthy, so that childbed fever, certainly not a contagious disease, but under certain conditions a communicable disease, may be spread from one patient to another

"The environment around the locale of the clinic is as follows. two windows of the clinic open on the north light-court, and six on the west, the north light-court is two fathoms, five feet broad and includes the fire-wall of the adjoining house at the same level of the window, in this light-court, extending to the ground from the first and second floors are the privies of the building

"On the ground level next to the privies, are arranged the dust bins of the building. This rotting mass gives off a penetrating stench. The ground of the building is taken up by the quarters of elementary and pathological anatomy, directly under the windows of the obstetrical department is found the open sewer, into which all the liquid refuse of the elementary and pathological anatomy is thrown. The first floor is occupied by the chemical department, in the corner, where the north and west light-courts come together, is the morgue of the clinic the west light-court is one fathom wide and inclosed by a three-fathom high wall, beyond which is found an unoccupied open area. This court is occupied in part by the morgue, on the ground level the quarters of elemental and pathological anatomy, on the first floor the chemical department.

(p 87) "This is not the place to air the theory of the undersigned on the origin of childbed fever, it is sufficient to state that he harbors the conviction that, no single case excepted, all cases arise from the absorption of a decomposed animal-organic matter.

"An honorable professorial college can conceive the pitiable situation of the Professor of Obstetrics, when he, with such a conviction, has only the choice either of closing the windows hermetically and thus allowing his puerperae to be made ill by the air befouled in an insufficient space by a large number of

medical students and pupil-midwives, or to admit through the open window the air permeated with decomposed organic matter from the two light-courts

"As gloomy as the present is in this clinic, yet there threatens, if it should remain in the same quarters, an even more dismal future

"On the vacant ground beyond the west light-court, a two-story building is to be erected, thereby will not only the light be excluded from the windows of the obstetrical clinic, but the exhalations bringing childbed fever from a light-court only a fathom wide will, in case their escape is made impossible over the vacant ground, be conducted in a highly dangerous concentration by the two-story structure through the windows of the clinic

"But whether the puerperae in the clinic of the undersigned are to enjoy a healthy situation, or whether they are to be carried off by childbed fever, is important not merely for the patients in this clinic, the results of the efforts of the undersigned with regard to the condition of health (p 88) of the puerperae treated by him are significant for the whole of mankind

"The fact, that childbed fever causes a strikingly greater number of deaths in the lying-in hospital than outside it, is known not only to physicians, but also to the laity, and in official documents the lying-in hospitals are called "murder-dens," not only by physicians, but also by administrative officials

"Based upon the fact, that childbed fever causes a greater devastation in lying-in hospitals, the question has been repeatedly brought up for discussion as to whether it would not be of more benefit to the human race to tear down all lying-in hospitals.

"Only a frightful dilemma has saved the lying-in hospitals from destruction

"If individuals are delivered in the lying-in hospitals, then childbed fever causes a frightful devastation among them, and a considerable number in the bloom of life go to an early grave

"If, as a result of the suppression of all lying-in hospitals, the births take place outside of the lying-in hospitals, then those delivered will remain completely healthy in greater numbers but begin to worry about the future of themselves and their children,

and as a result of need will then arise the crimes of abortion, child-abandonment and infanticide

"For that reason the lying-in hospitals should be allowed to continue in existence, because it would be better to expose the parturients in the lying-in hospitals to the dangers of childbed fever than to distress outside the lying-in hospitals, because such a large number of them would be thrown into prison

"Your most humble petitioner has found the cause of this devastating childbed fever and has shown how to prevent it. The attention of all adherents and opponents of this doctrine is called to the state of health among the puerperae treated by him, (p. 89) his supporters would become less resolute and his opponents would be confirmed in their doubts, if the state of health among the parturients cared for in the clinic becomes such an unfavorable one, that the spread of this doctrine would be hindered and thus the human race would still be harassed by a pestilence over a longer period, as the case would be, if the results even in the obstetrical clinic at Pest could speak for themselves

"In this opinion of the unsanitary condition in the obstetrical clinic, the undersigned is not alone, for the professorial college shared this view at a time, when I had not yet had the honor to be a member of it, when they said 'In pursuance of the decree of the noble Imperial and Royal Governor's office at Buda of September 17, 1854, No 19,548, a motion was made on the part of the Professorial College on March 17, 1855, to remedy the defects, which were the most noticeable hindrance to the favorable advance of the Institute of the Medical Faculty'

"In this petition, it says among other things "The corruption of the air from the overcrowding of the sickwards is increased in a most highly regrettable manner due to the fact, that the clinical divisions are in such contact with certain departments, that directly the doors and windows are opened, the room atmosphere is further befouled. The obstetrical clinic, for example, is in the second story directly over the chemical department on the first floor and the anatomical institute on the ground floor, and accordingly the noxious kinds of air developed in the two last-named departments in their escape upwards sweep by the win-

dows of the obstetrical department, and as a result immediately the doors and windows in the obstetrical department are opened, the unhealthy vapors generated in the institutes of the two lower floors, instead of the good air, are admitted into the obstetrical department (p 90) Herein is to be found indeed the most important cause for the outbreak of puerperal fever, and the reason why the obstetrical clinic must be repeatedly closed at intervals during the school year. That rooms in this clinic may be used for a "Course in Operative Surgery," would give only an even greater impetus to the above-mentioned evil, requires scarcely any further discussion, etc., etc.' (Nevertheless such a thing was done)"

"The views of the undersigned and the professorial college towards the lack of sanitation in the obstetrical clinic are not peculiar to them, but are shared by the general public. The common view found expression in an article in the "Wiener medicinischen Wochenschrift" of July 18, 1857. In this article, which bears the title. "The Medical School at Pest, No V," it says

"'Memento nasci

"'X Y Z Grande misère one calls that play in "Boston-Spiele," in which the player must endeavor to the timely discard of the good cards, and particularly the trumps, to so rid himself of cards, that it will be impossible for his opponent to force a trick on him Such a victory is in no way easy I was reminded of this play by a visit to the obstetrical clinic here, where it also seems to be intended, even with the timest good quality, to obliterate the impression, which brings out for the unprejudiced visitor all the numerous inadequacies and defects of the institution, grande misère again, because it would be difficult to find a second example of this accumulation of nuisances In the discussion of this clinic, I start first of all at the bottom, because there will perhaps be awakened several times in the reader the thought, that in this clinic (p 91) there must be some peculiar conditions These peculiar conditions will now be described The clinic is situated on the second floor, and indeed in the furthermost part to the rear of the whole building, so that the poor

women in labor must not only travel considerable distances from one part or other of the city, but are compelled to drag themselves up two flights of stairs and through a long corridor, so that it happens that births on the stairs are not a rarity This injudicious location of the clinic at a considerable distance from the entrance of the building is even more harmful in a lying-in hospital, because, on account of the limited space, only such women are admitted, whose labors have begun or are imminent, and not in the last two months of pregnancy as in Vienna does the location of the clinic in the sense indicated above leave much to be desired, but the windows on the one side open on the dead-house, while others are directly over the dissecting room. As if that were not enough, there are to be found in one wall of the actual sick-ward about three, well-drawing chimney flues of the chemical laboratory on the first floor directly underneath the obstetrical clinic, which in the middle of the summer turn the wall into a veritable giant oven If one does not believe this, let him place his hand on the wall, I know for a fact, that he will not do it a second time and will take my word for it in the future

"The clinic consists of five rooms, of which three have one window, one two windows, and lastly a corner room with three windows Of those with one window, there is one so small that there is only room enough for the nurse. Accordingly there remain only four little rooms for the puerperae The delivery room, as already stated in a previous letter, has only one window and three beds, one of which stands against the window should now picture a busy clinic, attended this semester by 93 pupil-midwives and 27 medical or surgical students, (p 92) with the thermometer at 26°R in the shade—and if one has a sufficiently lively imagination, let him imagine finally the troubles of the operating Professor under such conditions, or the tenfold distress of the patient being operated upon Here also, as in the wall with the chimneys, was recently offered to every optimist a rich opportunity for a penetrating argumentum ad hominem There lay on the diagnonally placed bed, a truly pitiable creature; instructor, assistant and a dense throng of pupil-midwives and medical students stand around it, even in the third room beyond

they are closely packed head to head, able only to hear the patient's screams without being able to see, heat, that was rather more capable of forcing one out of the world, than of attracting one into it, the sweat stood out in beads on the forehead of the professor, as the version was complete, and just as he was in the act of introducing the first blade of the forceps, he came so near to an actual faint, that he was compelled to give over to his assistant the instrument he was inserting and to remove himself from the unbreathable atmosphere of the clinic It is truly remarkable, and in any case, speaks wonders for the rational and scrupulous care of the puerperae, that puerperal diseases in the last year in spite of all these difficulties have rather decreased than increased But what would one do with the sick patients, if indeed that were not the case, since, besides the 3 labor-beds, there are only 23 beds available, 1 e in the one-window rooms three, in the two-window room with the artificial tropical climate eight and in the corner-room twelve If indeed one cannot imagine that the course of the puerperium in Africa is not a more favorable one, we can convince him of it in a more gentle fashion, viz with a simple exercise in numbers During the course of a school year, there were nearly 600 deliveries, which was possible only because the puerperae as a rule left the institution with their babies the ninth day, if puerperal fever raged here as in the lying-in hospital in Vienna, (p 93) then scarcely the number of 100 births would be attained

"But this, one might say, is a fine quality in the obstetrical clinic, and we would be the last to deny it, but grande misère refers nevertheless to the material for instruction, and that, as is apparent, is in a bad way, of what use are 600 deliveries, if one is scarcely able to see a dozen of them! As is well known, a good two-thirds of these occur during the night, but are lost as far as instruction is concerned, for there is scarcely room for lodging the students or pupil-midwives at night. Consequently, only the two students on watch have opportunity for learning and even this only at the expense of their health, because they must pass the night in an over-crowded sick-ward, again by day, as previously indicated, one must endure a few thumps indeed, if

he wishes to penetrate into the small labor-room. Nothing is more dangerous for the student than the idea, that his effort is in vain, if this is once firmly established in his mind, then follows indifference or disgust in place of the original zeal, and even the scant opportunity is neglected, which may be offered here and there to one desirous of learning

"'As for the lectures, the situation is no better there is no proper lecture-room for this department, the Professor of Obstetrics is compelled to hold forth, when and where he has the opportunity, in winter on the ground-floor in the acologic lecture-room and in summer in the surgical lecture-room the lecture-room should not be overly occupied at seven in the morning and mostly by candle-light in the winter-time would not be a great misfortune, because it is a matter of common knowledge that the so-called theoretic obstetrics in the third year of the medical course is not worth much, and should soon give way entirely to a more rational teaching plan, but that the exceedingly important practical demonstrations on the phantom should be given, due to lack of the aforementioned "When and (p 94) Where," in the corridor between windows and doors, stairs and wash-kitchen, before a class of 120 men and women—that is as flagrant an abuse as is possible only in an exceptional school I make bold to ask, has one the right to condemn the country surgeon, who, not so long ago, did not recognize a uterine rupture, and altogether unknowingly severed a piece of gut? Was it possible, even with the best of intentions during his course of study, to obtain sufficient knowledge of this the most difficult of all the practical branches? Or is it not much more surprising, that such a tragic "Quiproquo" happens so seldom, that is to say, that in spite of such obstetrical teaching so many infants are born alive?

"Operative courses are an indispensable aid for instruction in obstetrics, they carry the beginners as a rule much further along the road to courage and skill, than do similar courses in surgery, but what is to be done about this part of the instruction in a teaching institution, where there is usually a lack of cadavers? "Finally, there is not the slightest opportunity to study

gynecology, a disadvantage which also prevails elsewhere indeed in obstetrical clinics, but a substitute for it is to be found in the gynecological section in the same building Up to a short time ago, and moreover for six whole years, the Professor of Obstetrics has conducted in the St Rochus Hospital a small department for diseases of women, entirely without remuneration, the opportunity was thus given to him to initiate one or another diligent students into this important subject, and thereby to do an incalculable amount of good for thousands, this has also, against his will, now come to an end Such tragic blunders as putting a piece of intestine into the pocket, do not happen every day, but daily the curet is used for plethora, instead of the ligation of a polyp, and every day Rheum (p 95) with Aloes is prescribed, instead of notice being taken of the excoriation present, in reality, the young physician is admitted to practice with an ignorance of the diseases of women, which makes one actually afraid for the continued existence of the more lovely half of humankind, which is moreover the greater'"

In the school year 1855-6, 514 puerperae were cared for, of whom five died, two of childbed fever and three from other diseases, consequently the death rate from childbed fever was 0 19%

In the school year 1856-7, 558 women were cared for, among whom there were 551 puerperae and 7 gynecological cases, out of the 558, there died 31, 16 from childbed fever and 15 from other diseases, therefore the death rate from childbed fever was 2 9%

In the school year 1857-8, 457 women were treated, of whom 449 were puerperae and 8 gynecological cases, of whom 23 died, 18 from childbed fever, and 5 from other diseases, a death rate of 405%

The mortality of 2 9% in the school year 1856-7 and of 4 05% in the school year 1857-8 from childbed fever among the puerperae occasioned an official correspondence, which we shall give here in part, so that the reader may know the causative agent of this mortality. It says among other things "Reports have been made confidentially, which have to do with manifold deficiencies and (p. 96) imperfections in the obstetrical clinic of the Imperial

and Royal University, that, for example, through the negligence of the principal midwife N N, not only are the bedclothes of the puerperae seldom changed, but even the blood-stained bedclothes of dead puerperae were spread under newly admitted women, and as a result, the mortality at the beginning of this year has reached such a high point, that, on one day, even ten puerperae died

"This fact must be even the more shocking, since in the previous year with a far lower mortality, this condition was immediately reported by the Professor, and appeal was made for a greater provision of bed-linen, which was immediately granted to the extent that a supply of several hundred sheets over the requirements remain for disposal Likewise, the supplies of beds and their equipment, and body-linen were furnished to the entire amount requested, during the vacation months, to such an extent that the high cost of providing them did not escape the notice of the Honorable Ministry for Culture and Education.

"Therefore the Imperial and Royal Professor shares also the conviction with the rest of the personnel who are familiar with the clinic, that it is not due to the lack of linen, even less to the regular delivery on the part of the laundress, but the inattentive and unregulated management of the change of linen carries the blame for the increased number of cases of illness and death"

Then I replied as follows. "It is indeed my conviction, as well as that of the other persons, who are familiar with the clinic, that the increased mortality observed in the beginning of the school year 1857–8 at the obstetrical clinic of this place should not be ascribed to the lack of linen, nor to the irregular delivery of the same on the part of the laundress, but that the inattentive and unregulated management of the change of linen (p 97) should bear the blame for the increased sickness and deaths. But this inattentive and unregulated management of the change of the linen is not the fault of the chief midwife, but of the nurse N N, who was discharged for that reason

"In the school year 1856-7, 31 puerperae died, 16 of them from childbed fever on account of the want of linen and the irregular delivery of the same on the part of the laundress

"In the school year 1857-8, 24 puerperae died, 18 of them from childbed fever on account of inattentive and unsupervised change of linen

"There were never more than two deaths in one day, if it is said that in the school year 1856–7 there was a much smaller mortality and that at the beginning of the school year 1857–8 the mortality was so great that even up to ten puerperae died in one day, this statement is not in accord with the truth

"Since bed-clothes soiled with the blood of dead parturients were never furnished to new arrivals, then those sheets, soiled with blood and lochial discharge, and returned from the laundry as washed clean, must be referred to, the same sheets, which I personally had the honor to display, with the information, that these sheets had caused childbed fever in my clinic

"From the first medical writers, from Hippocrates down to the present time, it has been the uncontested conviction of all physicians of every age, that the fearful devastations, which childbed fever has produced among the puerperae, are to be ascribed to epidemics, i.e. atmospheric influences, influences which evaded every virtue of the physician, and go on manifesting their ravaging power unswervingly and irresistibly. I was able, (p. 98) during the year 1857 in the great Vienna Lying-in Hospital, to show that this view was erroneous, and that each single case of childbed fever was caused by infection. As a result of measures which I devised according to my views, I have had no epidemic in Vienna for 21 months, in St. Rochus Hospital for six years, and at the clinic in Pest for one year, i.e. in three institutions, which were formerly visited regularly by frightful epidemics.

"The two disastrous years which then followed, I have described in the "Orvosi Hetilap" as entirely due to chance, although tragic proof for the correctness of my views on the origin of childbed fever

"My opinion on the origin of childbed fever with regard to the beneficence of its results has been compared to Jenner's cow-pox inoculation. I realize strongly, how immodest it is for me to say something of myself, but the fact that my clinic was directly blamed for the greater mortality forces me to do so. It is neces-

sary therefore that the mounting mortality in the obstetrical clinic at Pest, due to no fault of mine after nine years of brilliant success, should appear in a more favorable light"

From this official correspondence, the reader will perceive that the mortality among the puerperae during these two years was due to the fact that other unsanitary conditions in the clinic were added to that of the bed-linen

The laundry work was in charge of a contractor, who was obliged to exchange clean bed-linen for the soiled only once a week, the amount paid for laundry work seemed too high to the different authorities, a minimum bid was asked for

Under this minimum bid, it was understood that the laundry work (p 99) would not be given to the contractor who would wash it best, but to the one who would do it the cheapest

Thus the price was forced down to the point, where it was impossible, particularly in winter, to furnish clean linen, and through the use of badly washed bed-linen, childbed fever was caused. After this was complained of, the laundry work was again assigned to the previous contractor at the old price, and as a result of this measure a stop was put to the frequent illnesses.

During the school year 1857-8, it was again dirty bed-linen that caused increased mortality, not that soiled linen was delivered dirty by the contractor, but because the attendants neglected to change the bed-linen regularly and lochial discharge underwent such a putrefaction, that it caused childbed fever

By thorough cleaning of the bedding and by dismissal of nurses implicated, the mortality was checked

We have previously pointed out that the greater mortality in the First Obstetrical Clinic in Vienna compared with that in the Second was due to the cadaveric particles, which adhered to the hands of the examiner

We have previously shown, that in October, 1847, the ichorous particles from a discharging medullary carcinoma of the uterus had caused childbed fever, we have shown that in November, 1847, the ichorous particles from an odorous carious knee had caused childbed fever, we have shown that in the obstetrical clinic of the St Rochus Hospital the various decomposing animal-

organic matter, which occurs so plentifully in a surgical department, had caused childbed fever

During two years, childbed fever was engendered in the obstetrical clinic at Pest by putrefying bloody and lochial discharges, which soiled the bedsheets.

The carrier of the cadaveric particles, of the ichorous particles, of the ichorous discharge from the medullary carcinoma of the uterus, of decomposed organic matter from the surgical department was the examining finger, the carrier of the odorous ichorous particles from the carious knee-joint was the atmospheric air, the carriers of the decomposed bloody and lochial discharges, which caused childbed fever during the school years 1856–7 and 1857–8 in the obstetrical clinic at Pest, were the sheets and the atmospheric air, because the parturients, lying upon such sheets brought their genitals, traumatized by labor, in contact with these decomposing materials, and because the exhalations of these sheets penetrated into the genitals of the puerperae along with the atmospheric air

The chlorine washings were resorted to very assiduously during the three years, in which I functioned as director of the obstetrical clinic. The mortality, in spite of this, of 2 9% in the school year 1856–7 and of 4 05% in 1857–8 does not speak against the usefulness of the chlorine washings, because they can only free the hand as carrier of the decomposing animal-organic matter, and upon the other carrier of the decomposing animal-organic matter, namely the sheets, washing the hands with chlorine-water can have no influence

The fact that infants do not fall ill of childbed fever simultaneously with the mothers ill of childbed fever, serves as proof, that the infection does not occur during labor, but during the puerperium. Therefore, I had to absolve the students of any blame, and extend my investigation to the utensils of the lying-in bed, (p. 101) and there were indeed the previously mentioned sheets soiled with putrefying bloody and lochial discharge

If my conviction is correct, that childbed fever in the great majority of cases arises from the admission of a decomposing animal-organic matter from without, and if the decomposing material is introduced into the puerperae from without by means of the sheets, and as a result of this, childbed fever actually occurs, then these cases of illness are direct proof for the correctness of my opinion of the origin of childbed fever

In the school year 1857–8, the external genitals of two individuals ill from childbed fever became gangrenous Because of lack of room, they had to remain among the other puerperae, so, in order to isolate them as much as possible, two pupil-midwives were detailed to their care on twelve-hour shifts with orders to touch no other patients, nevertheless one of the assigned pupil-midwives was caught when she was preparing to examine a newly-admitted parturient

(p 102) CONCEPT OF CHILDBED FEVER

Based upon experience acquired during 15 years in three different institutions, all terribly harassed by childbed fever, I believe childbed fever, no single case excepted, to be a resorption fever, dependent upon the resorption of a decomposed animal-organic matter, and the first result of the resorption is a disintegration of the blood, and after this the exudates

The decomposed animal-organic matter, which, absorbed, produces the childbed fever, is in the vast majority of cases conveyed to the individuals from the outside, and this is infection from without, these are the cases which make up the epidemics of childbed fever, and these are the cases which can be prevented

In rare cases, the decomposed animal-organic matter, which, absorbed, causes childbed fever, is produced within the limits of the affected organism, and these are the cases of auto-infection, and these cases cannot all be prevented

The source from which the decomposed animal-organic matter is derived, which, conveyed to the individual from without, causes childbed fever, is the cadaver of every age, either sex, whose disease brings about the production of a decomposed animal-organic matter, without consideration as to whether it is the cadaver of a puerpera or of a non-puerpera, only the extent of the putrefaction is to be considered

(p 103) They were the various cadavers, on which those who made examinations in the First Clinic practiced or dissected The sources from which the decomposed animal-organic matter

is derived, which, conveyed to the individual from without, engenders childbed fever, are all sick persons of every age, of either sex, whose illness brings about the production of a decomposed animal-organic matter, without consideration as to whether the sick person suffers from childbed fever or not, only the decomposed animal-organic matter as a product of the disease is to be considered

At the First Obstetrical Clinic in Vienna, childbed fever was caused in October, 1847, by a discharging medullary carcinoma of the uterus, in November, 1847, by the ichorous exhalations of a carious knee-joint. In the St. Rochus Hospital at Pest, it was the various surgical diseases whose ichorous products caused childbed fever.

The sources from which the decomposed animal-organic matter is derived, which, conveyed to an individual from without, produces childbed fever, are all physiologic animal-organic structures, which, no longer subject to the vital laws, attain to a certain degree of putrefaction, not what the structure is, but the degree of putrefaction is to be considered

In the school years 1856–7 and 1857–8, in the obstetrical clinic of the Pest medical faculty, physiologic blood and normal lochial discharge were the etiologic factors of childbed fever, in that they, adhering to the bed-sheets for a long time, underwent putrefaction

The carrier of the decomposed animal-organic matter is the examining finger, the hand of the operating surgeon, instruments, bed-linen, the atmosphere, sponges, the hands of midwives and nurses, which come in contact with the decomposed excrement of seriously ill puerperae or other sick persons, and then again with parturients (p 104) and newly delivered puerperae, bedpans, in a word, carriers of decomposed animal-organic matter are all those things which are contaminated with a decomposed animal-organic matter and come in contact with the genitalia of patients

The place where the decomposed animal-organic matter is absorbed is the internal surface of the uterus from the internal os upwards, denuded of its mucous membrane as a result of pregnancy and presents a surface uncommonly capable of absorption

The upper parts of the genitals, which are not denuded of mucous membrane, in the intact condition, do not absorb on account of the thick layer of epithelium, but through injury, every place in the genital tract can become a portal of absorption

As for the time for infection, it seldom occurs during pregnancy, because of the sealed condition of the internal os, and hence of the inaccessibility of the absorptive internal surface of the uterus

In cases where the internal os is already opened during pregnancy, with the result that the internal absorbing surface of the uterus is accessible, infection from without can indeed occur during pregnancy, infection from without seldom occurs during pregnancy, because, in spite of the open internal os, the opportunity for penetration thus far with the examining finger is a rarity. I have indeed neglected to make notes as to how often in the year at the First Clinic in Vienna childbed fever occurred during pregnancy, but I think that it is near to truth, when I assume the number to be twenty cases. Pregnancy was always interrupted by childbed fever, a single case (p. 105) died during pregnancy from childbed fever, she was delivered by me with a post-mortem Cesarean section to save the baby

The period during which the infection occurs most often is the stage of dilatation, because then not only is the inner surface of the uterus accessible, but also the opportunity is then the most frequent for the insertion of the examining finger for the purpose of determining the presentation and position of the child

Proof of this is found in those cases which, before the use of the chlorine washings, had a prolonged first stage, and died, almost without exception, of childbed fever.

During the stage of expulsion, the internal surface of the uterus is made inaccessible by the advancing fetal part, and on that account, infection hardly ever occurs

In the placental stage and during the puerperium, the internal surface of the uterus becomes accessible again, and during this time, it is principally the atmospheric air, penetrating into the genitals, which carries the infection, if indeed it is permeated by decomposed animal-organic matter

In November, 1847, the air of a lying-in ward of the First

Clinic in Vienna was permeated by the emanations from a carious knee-joint and the air, so saturated, penetrated into the gaping genitals of the puerperae and caused childbed fever

During the placental stage and the puerperium, infection can also be caused by contact between the wounded surfaces of the genitals, injured by the passage of the fetus, and the bedding, which had been soiled by decomposed animal-organic matter

In this manner, childbed fever was caused during the school years 1856-7 and 1857-8 at the obstetrical clinic in Pest by unclean sheets

(p 106) The decomposed animal-organic matter which, being absorbed, causes childbed fever, in rare cases is not communicated to the patient from without, but originates within the body of the person affected, so that the organic particles, which should be excreted during the puerperium, undergo decomposition before their excretion and if they are then absorbed, engender childbed fever by auto-infection These organic substances are the lochia itself, decidual remnants, blood-clots, which are retained in the uterine cavity, etc, etc Or the decomposed animal-organic matter is a product of a pathologic process, eg as a result of a difficult forceps operation, portions of the sexual organs become gangrenous, and the gangrenous particles, if absorbed, engender childbed fever through auto-infection

If childbed fever is to be explained as an absorption-fever, dependent upon the introduction of a decomposed animal-organic matter, in which a disintegration of the blood occurs and exudation occurs as a result of this change in the hemic composition, yet childbed fever is not a disease, peculiar to and occurring exclusively in puerperae, because this disease can occur in pregnancy or during labor following the absorption of a decomposed animal-organic matter, we have found this disease in the newborn, male or female This is the disease we found in Kolletschka, we find the same as the result of an absorption of a decomposed animal-organic matter in anatomists, surgeons, in operative cases in the surgical departments, etc

Childbed fever is accordingly not a species of disease, but a

variety of pyemia

Different concepts are associated with the expression "pyemia," so it is necessary to explain what I (p 107) understand as pyemia. By pyemia, I understand a disintegration of the blood, brought about by the introduction of a decomposed animal-organic matter

I call childbed fever a variety of pyemia because, in the pyemia of gravidae, parturients and puerperae, it appears in a form in the genital organs which does not occur in the non-pregnant, non-parturients, or non-puerperae, the anatomist, or the surgeon who dies of pyemia cannot have endometritis, etc, etc

Childbed fever is not a contagious disease, for a contagious disease is understood as one, which produces the *Contagium*, by which it is spread, and this *Contagium* produces in turn only the identical disease in another individual. Smallpox is a contagious disease, because smallpox produces the *Contagium*, by which smallpox is again engendered in another individual, and no other disease. Scarlet fever cannot be produced from a case of smallpox, on the contrary, one can never produce another disease from smallpox, e.g. a person ill with scarlet fever cannot cause smallpox in another individual

But such is not the case with childbed fever, this fever can be produced in a healthy puerpera by diseases which are not childbed fever, thus we saw this fever caused in the First Clinic in Vienna by an ichorous discharge from a medullary carcinoma of the uterus, also by the emanations from a carious knee-joint, we saw childbed fever caused in the First Clinic by cadaveric particles, which came from a variety of cadavers We saw childbed fever caused in the obstetrical department of the St. Rochus Hospital by decomposed matter, which came from a surgical department, etc, etc.

But childbed fever cannot be carried from a puerpera (p 108) ill with childbed fever to a healthy one, if a decomposed animalorganic matter is not transferred from one to the other. For example, a puerpera is seriously ill with puerperal fever, if the puerperal fever appears in a form which is not due to the implantation of a decomposed matter from without, then this childbed fever is not communicable to a healthy puerpera, but if childbed

fever appears in a form which is due to the implantation of a decomposed matter from without, then this childbed fever is communicable to a healthy puerpera, e.g. a puerpera is ill with puerperal fever, it is septic endometritis, there are sanious metastases present, and from this puerpera, childbed fever can be communicated to a healthy puerpera

That explains why the dispute over the contagiousness or non-contagiousness of childbed fever can never be brought to a satisfactory conclusion, because the contagionists can cite cases where the spread of childbed fever from an ill puerpera to a healthy one could not be denied. And the opponents of the contagion theory can likewise bring forward cases in which the spread of childbed fever did not occur under circumstances where it should have happened if it were a contagious disease

Childbed fever is not a contagious disease but is communicable from an ill puerpera to a healthy one by means of a decomposed animal-organic matter

After death, every cadaver of a puerpera is a source of decomposed matter, which causes childbed fever, and only the stage of decomposition in the body of the puerpera is to be considered, as in all other cadavers.

If we assert that in the vast majority of cases childbed fever is caused by an infection from without, and that these cases (p 109) can be prevented, and that in the minority of cases childbed fever is due to an unpreventable auto-infection, then the question arises whether all deaths, occurring during the puerperium but not due to childbed fever, should be deducted, and if, as a result of precautions, all cases of infection from without could be prevented, how many puerperae then would ever die as a result of To this question, I cannot answer up to now auto-infection with figures, because the three institutions, in which I made my observations, did not fulfill the requirements which we demand for the prophylaxis of childbed fever in a lying-in hospital, should it be possible to prevent all cases of infection from without, or, in other words, the three lying-in hospitals, in which I made my observations, are so constituted, that it was not possible ever to prevent all cases of infection from without

The petition, which I have previously quoted in part, was meant to aid me in securing a new lying-in hospital which would meet the requirements which I had earlier laid down for the prophylaxis of childbed fever, were it possible to prevent all cases of infection from without

In case my suit should be successful, and I had made observations over a long series of years in a hospital so constituted, it should then be possible for me to determine the number of cases of unpreventable auto-infection. But should my request be fruitless, and should I be compelled to remain in my present situation, which bids defiance to every sanitary precept, then I must forego the collection of these figures and give up the task to a colleague, who, more fortunate than I, conducts a hospital, which (p 110) meets the requirements for the prophylaxis of childbed fever

For the present, I think there may be admitted, as a measure of the number of cases of unpreventable auto-infection, the report of the Vienna Lying-in Hospital from the period in which Medicine still got along without the pathological studies

In the last century and in the first decade of the present one, there were twenty-five years, in which less than one puerpera in a hundred died annually

(p 111) From this report the reader will see that during the period when Medicine in Vienna did without pathological studies, during two years one puerpera died out of 400. During two years, one puerpera out of 300 died. During eight years, there died one puerpera out of 200 and during 13 years less than one out of 100.

From this report, we can answer the question, "How many puerperae ever died as the result of unavoidable auto-infection?" by saying that, as a result of unavoidable auto-infection, less than one puerpera died out of 100

This trifling mortality, shown by the report of the Vienna Lying-in Hospital, is probably still not the least possible, because some of the deceased puerperae perhaps died, not from childbed fever, but of another disease, and at that time, there could also occur cases of infection from without, because discharge from a

sick puerpera could be transferred by the personnel of the lying-in hospital to a healthy one. That this actually happened is likewise proven by the report of the Vienna Lying-in Hospital during the time when Medicine in Vienna still did without pathological studies, because at that time also the mortality rose to 4 out of 100

TABLE XVIII

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Year	Births	Deaths	Ratio
1786	1151	5	Less than 1 in 200
1787	1407	1	Less than 1 in 300
1788	1425	5 5	Less than 1 in 300
1789	1246	7	Less than 1 in 200
1790	1326	10	Almost 1 in 100
1791	1395	8	Slightly more than 1 in 200
1792	1574	14	Less than I in 100
1794	1768	7	Less than I in 200
1797	2012	5	I in 400
1798	2046	5	I in 400
1799	2067	20	Almost 1 in 100
1801	2105	17	Less than I in Ioo
1802	2346	9	Less than 1 in 200
1803	2215	16	Less than I in Ioo
1804	2022	8	Less than I in 200
1805	2112	9	Less than 1 in 200
1806	1875	13	Less than 1 in 100
1807	925	6	Less than I in 100
1808	855	7	Less than 1 in 100
1810	744	6	Less than 1 in 100
1812	1419	9	Less than 1 in 100
1815	2591	19	Less than 1 in 100
1816	2410	12	Less than 1 in 200
1817	2735	25	Less than 1 in 100
1822	3066	26	Less than 1 in 100

The Vienna Lying-in Hospital was opened in 1784, and out of 39 years, viz up to 1823, there were 25 years, in which less than one puerpera out of 100 died. During seven years, one puerpera out of 100 died, during five years two out of 100 died, in one year, 1815, three out of 100 died, and in one year, 1819, four out of 100 died

If we take the 25 years, during which less than one puerpera

died out of 100 in the Vienna Lying-in Hospital, as a standard for the number of cases of auto-infection, (p. 112) mindful of the two previously cited considerations, that this number also probably includes cases of infection from without, and if we compare this standard with the results which we obtained by our measures for the prevention of puerperal fever in three different institutions which were all afflicted to a high degree by puerperal fever, then it shows that it is never possible to limit the number of sick patients to the cases of unavoidable auto-infection, but that from time to time cases of infection from without occur

In the last seven months of 1847, there died, in spite of the chlorine-washings, 56 out of 1841, or 3 04%

In 1848, when chlorine-washings were used throughout the whole year, there died 45 out of 3780 puerperae, or 1 19%

In January and February, 1849, 21 puerperae died out of 801, or 262% But if we take up the individual months, then only during seven months of the year 1848, is it possible to limit the deaths to cases of auto-infection, because in March, 1848, out of 276, and in August, 1848, out of 261 puerperae, not one died, and during five separate months, there died less than one puerpera out of 100

Month	Puerperae	Deaths	%	
Feb	291	2	o 68	
Aprıl	305	2	0 65	
May	313	3	0 99	
July	269	1	o 37	
Sept	312	3	0 96	

The reason that it was never possible at the First Clinic at Vienna to confine the deaths to the cases of auto-infection lay in the fact that the First Clinic certainly did not come up to the requirements which we demand for the prophylaxis of childbed fever in a lying-in hospital, (p 113) should it be possible to limit the deaths to the unavoidable cases of auto-infection. Besides, in the first period of our new convictions, we were so inexperienced, that in October, 1847, after the examination of a medullary carcinoma of the uterus, we did not wash in the solution of chlo-

ride of lime We were still so inexperienced in November, 1847, that we did not isolate the puerpera with the discharging carious knee from the rest, and therefrom we had numerous cases of infection from without, as we have related in the proper place

In the St Rochus Hospital at Pest, in six years we lost eight cases out of 933 from childbed fever. These eight deaths are not merely cases of auto-infection, for in one case, it was shown that it was caused by a surgical Secundarius after an autopsy on a man dead of gangrene, and that among the other seven cases, probably one or more could have been cases of infection from without, and the reader may find it credible, if I remind him once more, that all six windows of the obstetrical department opened on the dead-house, and by air currents flowing in the direction of these windows, decomposed matter could easily be carried into the rooms of the department, and by penetrating into the genitals of the puerperae, could cause childbed fever

In the obstetrical clinic at Pest, I lost in the first year of my activity two out of 514 puerperae from childbed fever, in the second year, 16 out of 551, and in the third year, 18 out of 449 The increased mortality in both years were cases of infection from without due to dirty bed-sheets

(p 114) ETIOLOGY

In the statement of the concept of childbed fever, we have expressed our conviction that all childbed fever, no single case excepted, is due to the absorption of a decomposed animal-organic matter. We have maintained that this decomposed animal-organic matter, which causes childbed fever on absorption, in the majority of cases is introduced into the patient from without, and that in only very few cases does the decomposed animal-organic matter originate within the individual affected

For us, therefore, that only is an etiologic factor in childbed fever which conveys decomposed animal-organic matter to the individual from without, for us, therefore, that only is an etiologic factor in childbed fever which causes a decomposed animal-organic matter to form within the individual

We have previously subjected to an examination the etiology

of childbed fever, accepted up to now, in its application to the explanation of the preponderance of mortality at the First Obstetrical Clinic in Vienna as contrasted with the Second

Here is the place to examine the previously accepted etiology of childbed fever, in as far as it conveys to the individual a decomposed animal-organic matter from without, here is the place to investigate the etiology, (p 115) accepted up to now, of childbed fever, to see in what measure it causes a decomposed animal-organic matter to form within the individual

Of the etiology of childbed fever accepted up to the present time, we shall accept only that as an etiological factor which conveys to the individual a decomposed animal-organic matter from without, we shall accept only that, as a causative factor, which causes a decomposed animal-organic matter to form within the individual

All of the etiology accepted up to now, which neither conveys a decomposed animal-organic matter to the individual from without, nor engenders a decomposed animal-organic matter within the individual, we shall not acknowledge as a causative factor in childbed fever

Today it is the most widely-spread conviction of physicians that, in childbed fever, there is a dissociation of the blood, and that the anatomical products of childbed fever are only the excretions from the disintegration of the blood. I also share in this belief

As causes, which brought about this disintegration of the blood, were accused epidemic and endemic influences, mental disturbances, errors in diet, chilling, etc., etc.

My conviction is that the disintegration of the blood, no single case excepted, is caused by the absorption of a decomposed animal-organic matter, which is either conveyed to the individual from without, (cases of infection from without), or which originates within the individual affected, (cases of auto-infection) Armed with this conviction, we shall now proceed to the criticism of the currently accepted etiology of childbed fever

We shall only acknowledge as an etiologic factor in childbed fever, (p 116) that which communicates to the individual a de-

composed animal-organic matter from without, or causes a decomposed animal-organic matter to form within the individual, either of which, when absorbed, causes a disintegration of the blood

We shall begin with the epidemic influences, and express our unshakeable conviction that there are no epidemic influences which are able to cause childbed fever, and that there never were epidemic causes of childbed fever, that the endless series of epidemics as enumerated in the medical literature were all preventable cases of infection from without, i.e. all diseases caused by the transmission of a decomposed animal-organic matter into the individual from without

The reasons, which give me the courage to contradict a conviction many centuries old, are as follows.

Before all reasons stands as an immovable rock, upon which I have built up the structure of my doctrine on childbed fever, the fact that it was possible for me by my regulations, beginning in May, 1847, up to today, April 19, 1859, ie for 12 years, in three different institutions, which previously were visited every year by frightful epidemics of childbed fever, to so confine the childbed fever to single cases to the degree, that even the most headstrong advocate of "epidemic" childbed fever cannot call this an epidemic. And if, indeed, the number of deaths were sometimes increased, then it could be shown, that the numerous deaths were not caused by epidemic, ie atmospheric-cosmictelluric influences, but by a decayed animal-organic matter, which, in spite of my precautions, was conveyed to the individual.

A puerperal fever, conditioned by atmospheric-cosmic-telluric influences, (p 117) is unpreventable, and behind this unavoidability hid the Epidemicists, so as to avoid every responsibility for the devastations of childbed fever. And I myself am aware of my helplessness in the face of the atmospheric-cosmic-telluric influences, I know not what may be done to keep away the murderous effects of the atmospheric-cosmic-telluric influences from the puerperae

If, in spite of this, it were possible for me to prevent the disease, considered unavoidable, then evidence is presented that this disease is not caused by unavoidable atmospheric-cosmic-

telluric forces, and that this disease is due to a removable cause, a decomposed animal-organic matter

To me, the large mortality to which the Epidemicists point in order to prove the existence of epidemic influences is no proof that there are epidemic influences, because I say no epidemic influences have caused this death-rate, but decomposed animal-organic matter, but the low death-rate in the establishments at which I worked should be proof for the Epidemicists that there are no epidemic influences, because, once more, I explain here to the Epidemicists, that I have not guessed the secret of rendering the epidemic influences harmless, and I have obtained the small death-rate for twelve years in three different institutions, previously visited by the so-called childbed fever epidemics annually, only because my efforts were directed toward keeping decomposed animal-organic matter (p 118) from the patients in my charge

I have already pointed out that the illness and death of many individuals from the same disease a ta particular time does not give the proper concept of an epidemic, for then every battle would be an epidemic, in every battle many individuals also become ill and die of the same disease at a particular time. The concept of the epidemics is given by the cause, which, independently of the number, has caused childbed fever, and only that childbed fever would be epidemic, which is caused by atmospheric-cosmic-telluric forces

After setting out this weightiest of all reasons, we shall now apply the previously chosen standard to the epidemic influences

That through epidemic influences no decomposed animalorganic matter is conveyed to the individual from without, is in and of itself evident and needs no proof

But it is conceivable that there are atmospheric-cosmic-telluric forces, which may cause the production of a decomposed animal-organic matter in many individuals at a particular time, which, being then absorbed, causes childbed fever through auto-infection, and such a childbed fever would indeed be epidemic

That this, which we maintain is conceivable, in reality does not occur, is supported by the following reasons

If childbed fever could be engendered by epidemic forces, then these influences, as we have seen happen with other epidemic

disease, must be limited to a particular season of the year, because it is not reasonable to believe that atmospheric influences opposed to each other should have the same effect

(p 119) By Table No II, we have shown that childbed fever is not limited to any particular season of the year, because child-bed fever occurs in each month of the year in greater numbers and in lesser numbers as well

But if we add to the period which Table No II represents the 21 months during which, under my supervision, the chlorine washings were practiced at the First Clinic in Vienna, 1 e from June, 1847, to February, 1849, inclusive, there come to light more definitely the enormous variations in the extent of the mortality in every individual month of the year, or in other words, it shows distinctly that the death-rate is independent of the season of the year, as Table No XIX shows

(p 121) It is the prevailing opinion that winter is the season which principally favors the outbreak of childbed fever, and if we take into consideration Tables No IX and X, it is then evident that in the winter months actually a more unfavorable state of health more frequently exists among the puerperae, and less commonly a more favorable one, while in the summer months frequently a more favorable and less commonly an unfavorable state of health is observed

But this phenomenon is not to be explained by the atmospheric influences of winter, for otherwise childbed fever could never occur to a greater extent in summer

This phenomenon is to be explained by the different occupations, varied according to the season of the year, of those who attend the lying-in hospital

After the long vacation in the months of August and September, the students go with new zeal to their studies, including Obstetrics, and in the winter months the press of students in the lying-in hospital is so great, that individual students frequently must wait weeks or months, until his turn comes in the admissions, while in the summer months, especially during vacation, frequently one-half to two-thirds of the places are vacant, in the winter months, the pathological and forensic sections, and the medical and

surgical departments are very diligently attended by those students, who are also busy in the lying-in hospital In the summer,

(p 120)

TABLE XIX

3543	Year		Deaths		Puerperae		%	
Month	Min	Max	Mın	Max	Max	Min	Mın	Max
Jan	1849	1842	9	64	403	307	2 23	20 82
Feb	1848	1846	2	53	293	291	o 68	18 0
Mar	1848	1846	О	48	311	276	0 00	15 4
Apr	1848	1846	2	48	305	253	0 65	18 9
May	1841	1846	2	41	305	255	0 78	13 4.
June	1848	1846	3	27	266	264	1 13	10 1
July	1848	1842	ı	48	269	231	° 37	20 7
Aug	1848	1842	0	55	261	216	0 00	25 4
Sept	1848	1842	3	41	312	223	0 96	18 3
Oct	1848	1842	• 7	71	299	242	2 34	29 3
Nov	1848	1841	9	53	300	235	2 90	22 5
Dec	1848	1842	5	75	373	239	1 34	31 3

their zeal is considerably diminished, the delightful surroundings of Vienna exert a greater attraction than the stinking dead-house

or the sultry wards of the hospital In winter, the Assistant in Obstetrics conducts the practical operative exercises on the cadaver before the afternoon four-o'clock visit, because in the morning the students (p 122) are otherwise employed, and after the afternoon visit it is already too dark at five o'clock In summer, the heat before the afternoon visit is indeed too oppressive and the operative exercises on the cadaver are done during the evening hours after the afternoon visit. Is it a matter of indifference for the patients, whether the students examine them before or directly after their work on the cadaver?

These are in part the influences which are dependent on the season of the year and in these circumstances only lies the reason, why in winter more frequently an unfavorable and in summer more frequently a favorable state of health was to be found among the puerperae of the First Division. If the atmospheric influences really had been the cause of the frequent unfavorable state of health among the puerperae during the winter, then allow me to ask, whether Vienna had no winter for 25 years, because in 25 different years there was no epidemic in the Vienna Lying-in Hospital and less than one puerpera out of 100 died. See Table No. XVII

Have the atmospheric influences of the two winters of the years 1847–8 and 1848–9 in Vienna changed as the result of the chlorine washings? In these two winters there were no epidemics, as a result of the chlorine washings

Have the atmospheric influences of the four winters in Pest changed as a result of the chlorine washings, which I supervised in the Pest Medical Faculty? During these four winters, there was no epidemic childbed fever. The increased death rate during two winters was due to bed-sheets, which were soiled by decomposed blood and lochial discharges.

The obstetrical department of the St Rochus Hospital was never used for obstetrics in the winter, but only during August and September, yet it was (p 123) ravaged to a high degree every year, as long as it was an adjunct of the surgical department

Since childbed fever must be dependent upon a certain season of the year, if it were due to atmospheric influences, certainly

childbed fever could only occur in climates corresponding to these seasons of the year—But cases of childbed fever in reality occur in great numbers in every climate—Moreover there are in every climate obstetrical hospitals, in which childbed fever does not occur to any great extent—The occurrence and non-occurrence of childbed fever in great numbers in lying-in hospitals distributed throughout all climatic conditions will not be explained by atmospheric influences, but only by decomposed animal-organic matter

In those lying-in hospitals, found in every climatic condition, in which decomposed animal-organic matter is conveyed to the individual from without, cases of childbed fever occur in great numbers and are then falsely called an epidemic

In hospitals, found in every climatic condition, in which no decomposed animal-organic matter is conveyed to the individual from without, childbed fever does not occur in great numbers, and hence these hospitals are spared by epidemics

A favorable state of health among the puerperae is shown by those lying-in hospitals, regardless of the climatic conditions, the reasons are obvious

An exception is made of those lying-in hospitals, in which, though not teaching hospitals, decomposed animal-organic matter is conveyed to the patient from without

In this category belongs the St Rochus Hospital at Pest, where the chief surgeon was also coroner and head of the obstetrical department, and, in addition, at that time there was no prosector (p 124) The physicians of the various departments were required to do their own autopsies

In this category belongs also the pay-pavilion, or department for private obstetrical patients in Vienna It was never used for teaching, and as was its purpose, was hermetically closed to all physicians not appointed to it. It may then be assumed that, in these lying-in hospitals, no cases of infection from without need occur, and less than one puerpera in 100 should die. However a glance at the mortality table, Table XX, of this department shows us something else

This table makes out the mortality smaller than it actually was because, frequently some hours or days after delivery, puerperae

were discharged from the pay-pavilion, some in good health to go home, others, who were ill, to enter the general hospital. This table shows the state of health among the patients of the pay-pavilion to be more unfavorable than it was (p. 125) in the First Clinic during the time when I supervised the chlorine washings.

This riddle will no longer be a riddle to the reader when I have made him familiar with the conditions

The directors of this department were Mikshik and Chiari. The reader who is familiar with the medical literature will know what these two physicians have accomplished But they could accomplish these things only because they were occupied with

TABLE XX

Mortality Table for Private Pavilion, Vienna Lying-in Hospital

Year	Births	Deaths	%	
1839	202	6	2 9	
1840	204	6	2 9	
1841	249	7	2 8	
1842		10	2 7	
1843	358 3 ⁶ 7	19	5 2	
1844	362	8	2 2	
1845	311	6	19	
1846	315	3	0 9	
1847	258	3	I I	
1848	213	4	18	
	2839	72	2 5	

affairs in which their hands must necessarily be contaminated with decomposed matter, both physicians were at the same time directors of the gynecological department of the general hospital, how dangerous a gynecological department can be for an obstetrical department has been demonstrated by the discharging medullary carcinoma of the uterus which was responsible for the tragedy of October, 1847, in the First Clinic

In the general hospital in Vienna, 600-800 medico-legal autopsies were done annually, and according to custom, one of the two younger Primarii, alternating weekly, must attend as the legal witness. When Mikshik was appointed Primarius, he naturally

was the youngest and after Mikshik's departure, Chiari was in turn the youngest, and the two, therefore, must alternately attend the forensic autopsies

Is the unfavorable state of health among the puerperae in the

private pavilion still a riddle?

Lying-in hospitals used for teaching show a more unfavorable state of health among their puerperae than those not devoted to teaching

And of the teaching hospitals, those used exclusively for the instruction of midwives show a more favorable mortality ration than those (p 126) devoted solely to the training of physicians

The reason for this difference in mortality in the teaching hospitals lies in the fact that the system of instruction of midwives is so arranged that the pupil-midwives need not contaminate their hands with decomposed matter, while the curriculum for medical students is such that their hands are soiled with decomposed matter much more frequently

An exception is made by the "Maternité" in Paris which, although used exclusively for the teaching of midwives, yet has as high a mortality as Dubois' clinic for training physicians, and of its location Dr Arneth says. "Its close proximity to the autopsy-room is regrettable. That the mortality in the Maternité is just as high as in Dubois' clinic is shown in Table No XXI

(p 128) In the Maternité, the system of instruction is such that the midwives contaminate their hands with decomposed matter as frequently as only physicians do elsewhere

My authority for his statement is Johann Friedr Osiander

In a book which bears the title "Observations on French Obstetrics, Together with a Detailed Description of the Maternité in Paris Hahn Bros, Hanover, 1813," he says in the Preface, that he was in Paris from May, 1809, until 1810, where he was so fortunate as to enjoy the friendship of Baudelocque, and through him gained admission to the Maternité

On the methods of teaching which were used there, he gives

the following account (page 33)

"The daily visit, which the physician in the Infirmary of the puerperae makes, is attended by the chief midwife and part of the

pupil-midwives Each pupil is assigned a patient for particular observation, and is required to write up in a short case-history the course of labor and orders of the physician These case-histories are called "Bulletins cliniques," and Professor Chaussier went to considerable trouble to instruct the pupils in writing them. For every patient, he watched the Bulletin closely, and placed in

(p 127)

TABLE XXI

Year	Maternité in Paris			Dubois' Clinic		
	Births	Deaths	%	Births	Deaths	%
1828	2920	163	5 58			
1829	2788	252	9 03		1	l
1830	2693	122	4 45	ĺ		
1831	2707	254	8 73			
1832	2582	146	5 65			
1833	2536	109	4 29]	1	
1834	2629	97	3 68		1	ł
1835	2632	92	3 49	264	22	8 3
1836	2586	57	2 20	242	17	8 33
1837	2829	45	I 59	358	31	8 6
1838	2983	81	2 71	516	25	4 8
1839	3407	122	3 58	438	24	5 40
1840	3701	94	2 53	582	26	4 40
1841	3515	114	3 24	596	22	3 69
1842				830	34	4 09
1843			}	730	39	5 34
1844	3410	164	4 92	903	41	4 54
1845	3302	139	4 20	884	44	4 9
1846	3531	143	4 04	901	42	4 66
1847	3752	133	3 54	1088	31	2 84
1848	3671	110	2 99	940	24	2 56
	58,374	2,441	4 18	9273	422	4 5

it a confidence of which I seldom found it worthy. Of course, among the pupils there were several who had sufficient talent and diligence to observe the disease-conditions and to write out the case-histories. These few give all the others the models for their reports, and as a result I have seen in several Bulletins on the different cases the same symptoms stated in the same words. In general, it is (p. 129) extraordinary enough to watch young girls

feel the pulse with an important manner and set down their remarks on the disease-condition. They imitate the manners of the chief midwife, their instructress, whose "airs" at the bed-side are so exalted, that the physician is always of her opinion."

On page 46, he writes "The autopsies, performed in the summer-house some distance from the lying-in hospital, are usually attended by the pupil-midwives. There I have often been astonished to see the lively interest which some young girls took in the mutilation of the cadavers, and how, with bare and bloody arms, they dissected out the pelves with large knives in their hands, amid laughter and wrangling, after they had obtained permission from the physician to prepare them for their own use"

On page 51, Osiander says "Among the findings at autopsy, which Baudalocque pointed out to this audience, the rupture of a psoas muscle from the strain of labor was important"

"The following table of the previous deliveries was given From December 9, 1797, to May 31, 1809, there were 17,308 women delivered of 17,449 infants, 189 twins, 1 e 1 out of 91, and only three had triplets At least 2,000 parturients became gravely ill and 700 died and were autopsied"

On page 242, Osiander says "The abdominal inflammation, the disease, which is usually designated by the name "Puerperal Fever," and tends to become endemic in all large and overcrowded lying-in hospitals, also appeared frequently in the lying-in hospital at Paris"

"This disease was particularly common during the winter months, and although in reality present continuously, two dreadful years (between 1803 and 1808) are especially remembered, when it raged endemically and carried off a multitude of women Although I (p 130) was unable to obtain any exact figures on the mortality among the puerperae during these two years, and the cautious authors of the treatise on the Maternité (Mémoire sur l'hôspice de la Maternité Paris, 1808 The three authors were all assigned to the Bureau of Hospitals, and were commended by the Administration for their proven discretion in the report) do not speak of it with any precision, it is certain for all that, that it must have been very great, from the fact that, in the five

years cited (on account of the two years, in which the abdominal inflammation raged), the mortality was in the ratio of 1 to 23, while at other times it was 1 in 32. During these five years, 414 out of 9645 women died, for the most part from abdominal inflammation."

On page 259, he writes "While I was visiting the Maternité, gangrene of the genital organs appeared at different times among the puerperae, exactly at the time when the abdominal inflammation was prevalent. To me, this disease, in the dreadful form in which it appeared, was entirely new, but in the Maternité, it caused no particular sensation, because it was nothing unusual"

The reader can imagine, from these quotations, the extent to which the midwives in the Maternité defiled their hands with decomposed matter

At any rate, it is not possible that, of several lying-in hospitals under the same climatic conditions, some were visited by the so-called epidemic childbed fever, and still others in the area were spared, if childbed fever can be engendered by atmospheric-cosmic-telluric influences, still less is it possible that atmospheric-cosmic-telluric influences should manifest themselves by their devastations in two divisions of one and the same institution to a different degree

(p 131) Table No. 1 shows, that the puerperae in the First Clinic over a period of six years invariably died in a three-fold greater number than the puerperae in the Second Clinic

This is the observation, which first aroused in me the doubt

about the doctrine of epidemic childbed fever

This disproportion in mortality in two divisions of one and the same hospital, we find also in Strassburg Dr F H Arneth, in his book, "Obstetrics and Gynecology in France, Great Britain and Ireland," Vienna, 1853, writes as follows of the Strassburg Lying-in Hospital. "The lying-in hospital is made up of two divisions, the clinic for physicians (la Clinique) and the department, where midwives are trained (le service) Up to the end of the year 1845, these two divisions existed side by side under two directors, separated only by a thin wall, and the admissions were so regulated, that alternately one gravida was taken into

the service, and the other into the clinic, but during vacation all were taken into the clinic Since Ehrmann's departure, Stoltz oversees both divisions

"It was not possible to obtain exact figures on the mortality, yet both Professors agreed that, in the clinic, more deaths always occurred"

In order to obtain more exact information on these passages in Arneth's book, I wrote to Dr Wieger and Professor Stoltz in Strassburg and through their kindness, obtained the following answers Dr Wieger writes

"Your esteemed letter of the 15th of last month would have been answered much earlier, could I have obtained a dissertation by Gustave Levy, "Relation de l'Épidemie de Fièvre Puerperale observé aux Cliniques d'accouchement de Strassbourg, pendant le I Semester de l'année scolaire 1856–1857", (p. 132) wherein are discussed just these conditions, on which you wish information. I am sending you my own copy, because I cannot procure another. You should be able to obtain one from a book-seller You will learn therein, that since the two divisions are in their new location, the disease has visited both."

"What Arneth has told you is true"

When the school for midwives was under the direction of Professor Ehrmann, puerperal fever was reasonably unknown Since Professor Stoltz took over both schools (the wards for gravidae and puerperae in their former location on the second floor of the large hospital were separated only by a room, in which stood the beds for the pupil-midwives living in the house) the disease infects both departments, as they are now united in a beautiful and newly-erected pavilion

Strassbourg, May 19, 1858

Professor Stoltz writes

"Allow me to answer in French your letter of May 1st, wherein you request an explanation of a passage in Dr Arneth's book, in which he states that, in the division devoted to the training of midwives, epidemics of puerperal fever are raie, and the mortality always less than in the clinic of the Medical Faculty

"The statement is correct, but I attribute the difference in

mortality to the health conditions of the two divisions. In reality, the wards of the obstetrical in the Medical Faculty are inferior, less roomy and continually overcrowded, while those for the midwives are well ventilated, well located, and in proportion to their size, always have a smaller number of beds. They are also (p. 133) kept cleaner, and in the course of a year lodge fewer gravidae and sick patients. On the other hand, the most serious cases are always referred to the Faculty clinic

"Up to the year 1856, both divisions were a part of the General Hospital Last year, they were removed to a building of their own, placed at a right angle to the old building, facing south and west, and provided with court-yards and a garden. The two clinics are now separated from each other by the lecture-room and the instrument room. The gravidae occupy the ground-floor, in short, the division for midwives is once more better arranged, than that for the faculty. Nevertheless in the winter of 1856-7, here as well as in Munich an equally fatal epidemic raged in both divisions, and in spite of the fact that disinfection of the hands by chlorine was practiced in the Faculty clinic.

"You will see, esteemed colleague, that our findings on your theory of the etiology of puerperal fever are not favorable Nevertheless, I shall read your work on this subject with the greatest interest, and have all your directions carried out with the greatest possible care

"I am glad to take part in a scientific intercourse with you and I should be happy, if it did not stop at just that

Strassbourg, March 26, 1858"

From Arneth's book and these two letters, it appears, that in Strassburg, the lying-in hospital is divided into two sections, of which the one, as long as it was used exclusively for the training of midwives, remained free from the so-called epidemic childbed fever, though separated only by a single room from the other division, which was devoted to the instruction of medical students exclusively, and was visited by the so-called epidemic childbed fever (p 134) After both divisions were united in 1845 under one director, the so-called epidemic puerperal fever spread to the

area previously free In 1856, the lying-in hospital was moved to a new building and again both divisions were visited by childbed fever. Is it not contrary to sound reasoning to maintain that childbed fever in the division for physicians, before the two were combined, was epidemic, i.e. engendered by atmospheric-cosmic-telluric influences?

Professor Stoltz himself seeks the cause of childbed fever in the division for physicians, not in atmospheric influences, but in endemic noxious factors and in particular in the difference in the health conditions of the two divisions, both in the new and the old lying-in hospital

That it was not these more favorable conditions, which protected the division for midwives from childbed fever as long as it was exclusively a midwives' division, is evident from the fact, that these same favorable circumstances no longer served to shield the area from childbed fever, as soon as it ceased to be exclusively a division for midwives

In the new building also, the more favorable arrangement of the midwives' division could not have protected it from childbed fever

Again, I maintain that the childbed fever, observed in Strass-burg before and after the union of the two divisions, was no epidemic, i e not due to atmospheric influences, but to an endemic factor, that the endemic cause was the decomposed matter, which adhered to the hands of the Strassburg students, and before the union of the divisions could only exert its pernicious effect on the one, but after the union, on both (p 135) in the old, as well as now also in the new, building

The futility of the chlorine washings will be subjected to a critical examination in another part of this work

The Strassburg midwives' school from the time of its union with the division for medical students, and the Second Obstetrical Clinic in Vienna from the time it was devoted exclusively to the instruction of midwives, up to the time of the introduction of the chlorine washings in the First Obstetrical Clinic in May, 1847, are proofs that the state of health among the puerperae, in such teaching institutions as are used exclusively for the training of

midwives, is more favorable than it is among the puerperae in teaching institutions for the training of physicians See Table No I

That the great mortality in the maternity hospitals is not due to atmospheric influences, but is caused by a decomposed animal-organic matter is evident from the fact that, in the separate maternity hospitals, it could be shown, that the so-called epidemic childbed fever became indigenous in the individual maternity hospitals at the time when the conditions themselves were so altered that decomposed matter was introduced with a certain regularity into the patients, cared for in the individual maternity hospitals

Osiander relates, that at the Maternité in Paris the two years between 1803 and 1808 are recalled with horror because of the frightful devastation which childbed fever caused among the puerperae, and in the teaching methods of the Maternité is found a sufficient cause for this childbed fever

In the same years, from 1803 to 1808, less than one out of 100 puerperae died in Vienna In Vienna, the so-called epidemic childbed fever became indigenous for the first time in 1823, (p 136) because this was the time, when Medicine began to assume an anatomic trend

Professor Rokitansky served from 1823 at the Institute of Pathologic Anatomy From 1823 to 1847, the year of the introduction of the chlorine washings, there were 23 years in which the mortality was always over 2%, and rose to 12% in one year, while from 1784 to 1822, 1 e for 39 years the mortality reached only 4%, and over a period of 25 years less than one puerpera out of 100 died See Table No XVII

From the Kiel Lying-Hospital, the late Michaelis says in a letter, which we shall give in detail in another place "You know that puerperal fever appeared here first since 1834. This was about the time when I began to take a more active part in the teaching, and especially since the pelvic examinations were regularly practiced by the students. Even this may have some connection"

In the Strassburg midwives's school, epidemic childbed fever

first appeared in 1845, the year it was combined with the division for medical students

While the state of health among the puerperae of the St Rochus Hospital at Pest since the establishment of the obstetrical department was always an unfavorable one, because the obstetrical department was nothing but an appendage of the surgical department, the state of health among the puerperae of the Medical Faculty was always a favorable one up to the "forties," because during that decade Medicine first took up the anatomical trend

My predecessor, Hofrath Birly, formerly Boer's assistant, considered the better state of health among his puerperae at Pest, in contrast with the miserable health conditions among the puerperae in Vienna, as due to the fact that he made an extensive use of purgatives, because childbed fever was caused by the uncleanliness of the bowel, at the opening of his clinic in October after the long vacation he regularly delivered a violent Phillipic against Vienna, and asserted that the large mortality in the lying-in hospital in Vienna was due only to the neglect in prescribing cathartics.

But as soon as Medicine in Pest followed the anatomic trend, purgatives lost their prophylactic power, and the Pest Medical Faculty, at a time when I had not yet the honor to be a member, declared officially that, on account of the prevalence of childbed fever, the obstetrical clinic at Pest must be closed repeatedly during the school-year.

I cannot give the figures for these statements, because the protocols were lost during the revolution. The fact that I live in the city of which I speak is sufficient guarantee for their correctness

That the large mortality in the lying-in hospitals is not due to atmospheric influences, but to a decomposed matter regularly introduced into the patients from without, is obvious, because, if the conditions in a lying-in hospital are so changed that the introduction of decomposed matter from without cannot occur to the same extent, then the mortality decreases To this category belongs the Second Obstetrical Clinic, which, at the

time when it afforded training for physicians and midwives, had a greater mortality than since the time it was devoted exclusively to the instruction of midwives

But if, by the changed conditions, the introduction of decayed matter from without wholly ceased, the epidemic childbed fever failed to return, in this category belongs the lying-in hospital at St Rochus in Pest, (p 138) which was separated from the surgical department and given over to my direction. For six years, I had no epidemic on account of the chlorine washings

That the large mortality in the lying-in hospitals is not due to atmospheric influences is evident from the fact, that, if suitable measures are adopted for the destruction of the decomposed matter, then the so-called epidemic childbed fever will not come again, after having been an annual visitor over a long series of years. To this category belong the First Obstetrical Clinic in Vienna and the obstetrical clinic in Pest. Of the experiences abroad on this subject we shall speak later.

We shall prove with figures what has been said about the appearance and disappearance of the so-called epidemic childbed fever, in so far as it applies to the Vienna Lying-in Hospital, which as already stated was opened on August 16, 1784 See Table No XXII

Until medicine in Vienna went over on an anatomic basis, there were 39 years, 1 e up to 1823, in which 71,395 deliveries occurred, of which number 897 puerperae died, or 1 25% After 1823, in the next decade, before the separation of the lying-in hospital into two divisions, there were 28,429 deliveries, of which number 1509 puerperae (5 3%) died See Table No XVII

In 1833 the medical students and pupil-midwives of both divisions were assigned to us in equal numbers for obstetrical training. On October 10, 1840 all medical students were assigned to the First Division and all pupil-midwives (p. 139) to the Second Division for obstetrical instruction by an Imperial decree.

During the eight years, 1833–1841, during which the medical students and pupil-midwives were equally divided between the two divisions, the height of the mortality fluctuated between the two divisions as Table No XXII shows

I regret that I obtained knowledge of this table so late, since I could not use it where I had need of it previously. The reader will therefore re-read pp 63-64

Through the assignment of all medical students to the First Division and all pupil-midwives to the Second Division, the mortality rose in the First Division and decreased in the Second Division, so that, up to the introduction of the chlorine washings, the middle of May, 1847, the mortality during these six years was as great on the average in the First Division as in the Second, as Table No I shows

2d Div 1st Div Year Births Deaths Births Deaths % % 8 2 26 1833 3737 197 5 29 353 8 60 2657 1744 150 1834 205 7 71 1682 84 1835 2573 143 5 55 4 99 1670 7 84 1836 2677 200 131 7 47 1837 1784 124 6 99 2765 251 9 09 1838 88 2987 1779 4 94 91 3 04 1839 2781 151 2010 91 4 05 5 04 2 06 1840 2889 267 9 05 2073 55 5 58 23,066 6 56 13,095 1,505 73

TABLE XXII

After the introduction of the chlorine washings, the mortality ratio of the two divisions (p 140) up to January 1, 1859, is shown in Table No XXIII

This table shows that after the introduction of the chlorine washings in the middle of May, 1847, the mortality in the First Division dropped to 6 35%, and in the Second Division to 0 32% But the mortality in the First Division is about 2 30% greater and in the Second about 1 79% greater than in 1848, when the chlorine washings were overseen by myself, I have not obtained the smallest possible mortality, for reasons which I have given in the proper place

The critical discussion of this increased mortality will follow in a discussion of the lack of success with the chlorine washings, (p 141) as observed by other accoucheurs For the unbiased reader, it should be sufficient to remark here that all physicians officially functioning in the two divisions during this period were and are opponents of my theory of the origin of childbed fever

My successor in the assistantship, Carl Braun, has written against my theory Carl Braun's successor, his brother Gustav, demonstrated what views he holds on the origin of childbed fever by the 400 deaths in 1854, a mortality, which, even by combining

(p	140)
VΡ	-40/

TABLE XXIII

Year		1st Div			2d Div	
ı cai	Births	Deaths	%	Births	Deaths	%
18471	3490	176	5 00	3306	32	0 09
1848	3556	45	1 27	3219	43	1 33
1849 ²	3858	103	2 06	3371	87	2 05
1850	3745	74	1 09	3261	54	1 06
1851	4194	75	1 07	3395	121	3 05
1852	4471	181	4 00	3360	192	5 07
1853 ⁸	4221	94	2 02	3480	67	1 09
1854	4393	400	9 10	3396	210	6 18
1855	3659	198	5 41	2938	174	5 92
1856	3925	156	3 97	3070	125	4 07
1857	4220	124	2 92	3795	83	2 18
18584	4203	86	2 04	4179	60	I 43
	47,935	1712	3 57	40,770	1248	3 06

¹ Semmelweis, Asst March 20, 1847 to March 20, 1849

the mortality of both divisions, was only surpassed three times in 75 years in the Vienna Lying-in Hospital, viz in 1842 with 730 deaths, in 1843 with 457 and in 1846 with 567

If we add to the 400 deaths of the First Division the 210 deaths of the Second during the same year, then the mortality during 1854 of both divisions with 610 deaths was surpassed only once in 75 years, 1 e in 1842, before the chlorine washings, with 730 deaths.

If we separate the mortality of the two divisions, then the mortality of the First with 400 deaths in 1854 was surpassed only

²C Braun, Asst March 20, 1849 to summer of 1853

³G Braun C Braun's brother, Asst and from April to Dec 1857, Acting Prof

⁴ K Braun, Professor

twice during these 75 years, in 1842 with 518 deaths and in 1846 with 459 deaths

For a more distinctive survey of the state of health of the puerperae in the Vienna Obstetrical Clinic, we shall give the principal figures, corresponding to the most important periods [Table XXIV]

(p 145) For every unprejudiced reader, this table must carry the conviction that the mortality among the puerperae during these 75 years was not affected by atmospheric influences, but that it was a decomposed animal-organic matter, which, according as it was introduced more or less frequently from without, caused the variations in mortality, as is clearly shown by the table. And since the natural law is the same throughout the whole world, so I maintain, supported by this table, that there never were atmospheric-cosmic-telluric influences capable of producing childbed fever and that the endless series of epidemics, as such are enumerated in the medical literature, were nothing but preventable cases of infection from without, i.e. all these cases of illness were due to the introduction of a decomposed animal-organic matter from without

That the so-called epidemics in the lying-in hospitals were not caused by atmospheric influences, but by the introduction of a decomposed animal-organic matter into the individual case from without, is demonstrated by the more favorable state of health among the puerperae in the lying-in hospitals in those countries where English views prevail, as in Ireland and Scotland, in comparison with the bad state of health among the puerperae in German and French lying-in hospitals

There are no reasonable grounds for the assumption that the atmospheric influences, which carry off the puerperae in such enormous numbers in the German and French lying-in hospitals, should not be able to do the same in England, Scotland and Ireland

(p 146) Accordingly, the difference in the state of health among the puerperae in the countries cited does not lie in the difference in the atmospheric influences. But the views of the English physicians on the origin of childbed fever are essentially

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TABLE XXIV

Pre-anatomic Medicine in Vienna Births 71,395, Deaths 897, 1 25%

Post-anatomic Medicine in Vienna Births 28,429, Deaths 1509, 5 30%

Division of Lying-in Hospital into 2 Sections-Students and Midwives equally divided in both

2d D1v

st Div

Births	Deaths	%	Births	Deaths	%
23,059	1505	6 56	13,097	631	5 58
		Before Chlor	ine Washings		·
M	ed Students Only	,		Midwives Only	
20,042	1989	9 92	17,791	691	3 38
	Afi	ter Chlorine W	ashings Introduc	ed	
47,838	1712	3 57	40,770	1248	3 06
		Total for B	oth Divisions		
91,043	5206	5 7 ^I	71,656	2670	3 72

Total for 75 Years

Births 262,523, Deaths 10,282, 3 91%

20 Years of Pre anatomic Medicine

	Puerperae	Deaths	%
25 years of less than 1%	44,838	² 73	0 60
7 years of less than 2%	12,074	185	1 52
5 years of less than 3%	9,332	219	2 34
1 year of less than 4%	2,062	66	3 20
1 year of less than 5%	3,089	154	4 98
39 years	71,395	897	1 25
10 Years of A	Aedicine on Anatomic B	asis	
1 year of less than 3%	2,367	51	2 15
3 years of less than 4%	8,961	317	3 53
2 years of less than 5%	5,923	284	4 79
1 year of less than 7%	3,353	222	6 62
1 year of less than 8%	2,872	214	7 45
2 years of less than 9%	4,953	421	8 49
IO	28,429	1,509	5 30

TABLE XXIV—Continued

8 Years following Separation into two Divisions—Equal numbers of Students and Midwives in both

т	ct	n	

	Puerperae	Deaths	%
1 year of less than 4%	2,987	91	3 04
3 years of less than 6%	9,084	491	5 40
2 years of less than 8%	5,334	405	7 59
2 years of less than 10%	5,654	518	9 16
8	23,059	1,505	6 56
	2d Div		
2 years of less than 3%	2,426	63	2 59
3 years of less than 6%	5,473	263	4 80
1 year of less than 7%	1,784	124	6 99
1 year of less than 8%	1,670	131	7 84
1 year of less than 9%	1,744	150	8 60
8	13,097	731	5 58
Six Years following Assignment of St.	udents to First and M 1st Div	Aidwives to Se	econd Divis
1 year of less than 7%	3,492	241	6 8
I July Of 1000 than 1/10	1 3747		
Tyear of less than 8%	2,026	2.27	7 7
1 year of less than 8%	3,036	237 534	77
2 years of less than 9%	6,217	534	8 5
•			
2 years of less than 9% 1 year of less than 12%	6,217 4,010	534 459	8 5 11 4
2 years of less than 9% 1 year of less than 12% 1 year of less than 16%	6,217 4,010 3,287	534 459 518	8 5 11 4 15 8
2 years of less than 9% 1 year of less than 12% 1 year of less than 16%	6,217 4,010 3,287 20,042	534 459 518 1,989	8 5 11 4 15 8 9 02
2 years of less than 9% 1 year of less than 12% 1 year of less than 16%	6,217 4,010 3,287 20,042	534 459 518	8 5 11 4 15 8
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5%	2d Div 9,951 2,442	534 459 518 1,989	8 5 11 4 15 8 9 02 2 40 3 05
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4%	6,217 4,010 3,287 20,042 2d Div	534 459 518 1,989	8 5 11 4 15 8 9 02
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5%	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739	534 459 518 1,989 239 86 164	8 5 11 4 15 8 9 02 2 40 3 05 5 09
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 8% 6	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739 2,659 17,791 atroduction of Chlorine	534 459 518 1,989 239 86 164 202	8 5 11 4 15 8 9 02 2 40 3 05 5 09 7 05
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 8% 6 Twelve Years after In	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739 2,659 17,791	534 459 518 1,989 239 86 164 202	8 5 11 4 15 8 9 02 2 40 3 05 5 09 7 05 3 38
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 8% 6 Twelve Years after In 3 years of less than 2%	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739 2,659 17,791 atroduction of Chlorine 1st Div	534 459 518 1,989 239 86 164 202	8 5 11 4 15 8 9 02 2 40 3 05 5 09 7 05 3 38
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 8% 6 Twelve Years after In 3 years of less than 2% 4 years of less than 3%	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739 2,659 17,791 atroduction of Chlorine 1st Div	534 459 518 1,989 239 86 164 202 691 Washings	8 5 11 4 15 8 9 02 2 40 3 05 5 09 7 05 3 38
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 8% 6 Twelve Years after In 3 years of less than 2% 4 years of less than 3% 1 year of less than 4%	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739 2,659 17,791 atroduction of Chlorine 1st Div	534 459 518 1,989 239 86 164 202 691 Washings	8 5 11 4 15 8 9 02 2 40 3 05 5 09 7 05 3 38
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 8% 6 Twelve Years after In 3 years of less than 2% 4 years of less than 3% 1 year of less than 4%	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739 2,659 17,791 atroduction of Chlorine 1st Div	534 459 518 1,989 239 86 164 202 691 Washings	8 5 11 4 15 8 9 02 2 40 3 05 5 09 7 05 3 38
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 8% 6 Twelve Years after In 3 years of less than 3% 4 years of less than 3% 1 year of less than 4% 1 year of less than 4% 1 year of less than 4% 2 years of less than 6%	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739 2,659 17,791 atroduction of Chlorine 1st Div	534 459 518 1,989 239 86 164 202 691 Washings	8 5 11 4 15 8 9 02 2 40 3 05 5 09 7 05 3 38 1 68 2 46 3 07
2 years of less than 9% 1 year of less than 12% 1 year of less than 16% 6 3 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 8% 6 Twelve Years after In 3 years of less than 2% 4 years of less than 3% 1 year of less than 4%	6,217 4,010 3,287 20,042 2d Div 9,951 2,442 2,739 2,659 17,791 atroduction of Chlorine 1st Div	534 459 518 1,989 239 86 164 202 691 Washings	8 5 11 4 15 8 9 02 2 40 3 05 5 09 7 05 3 38 1 68 2 46 3 07 4 00

TABLE XXIV—Concluded

Twelve Years after Introduction of Chlorine Washings—Continued

2d Div

	Puerperae	Deaths	%
1 year of less than 1% 4 years of less than 2% 2 years of less than 3% 1 year of less than 4% 1 year of less than 5% 1 year of less than 5%	3,306 14,139 7,166 3,395 3,070 6,298	32 224 170 221 125 366	0 09 I 58 2 28 3 05 4 07 4 8I
2 years of less than 7%	3,396	210	6 18
12	40,770	1,248	3 06

different from the opinions which the French and the German physicians hold on the same subject

The English physicians regard childbed fever as contagious, in France and in Germany, the opinion has always prevailed that childbed fever is not contagious. The latter is also my conviction. I have already given my reasons for this conviction and in this work will have the opportunity to take up this subject again.

But childbed fever is transferable from a sick gravida, parturient or puerpera to healthy gravidae, parturients and puerperae by means of a decomposed substance, which the diseased gravida, parturient or puerpera produces, childbed fever, however, is not communicable from every sick gravida, parturient or puerperae to healthy gravidae, parturients or puerperae during life, but only from those diseased patients who produce a decomposed substance. After death, childbed fever is communicable from every cadaver of a puerpera to the healthy patients, providing the cadaver has attained the necessary degree of putrefaction.

The English, proceeding on the opinion that childbed fever is contagious, do not attend a healthy gravida, parturient or puerpera, if they have previously attended a sick gravida, parturient or puerpera, without having previously washed their hands with chlorine water, or having changed their clothes, and if the number of cases of childbed fever increases, even go away on a trip or give up practice entirely for some time English physicians do not attend healthy gravidae, parturients or puer-

perae after an autopsy on the cadaver of a puerpera, without (p 147) previously washing their hands in chlorine water, or having changed their clothes

In all those cases in which the sick gravida, parturient or puerpera does not produce a decomposed matter, the English physicians do something rather superfluous, but in all cases where a decomposed matter is produced, the English physicians, with the idea of destroying a Contagium, destroy the decomposed matter which, if transferred to a healthy gravida, parturient or puerpera, would cause childbed fever

After the autopsy on the cadaver of a puerpera, the English physicians, with the idea of destroying a Contagium, destroy the decomposed matter with which their hands have been contaminated, with chlorine water

German and French physicians, with the conviction that childbed fever is not contagious and not recognizing the possibility of its transfer by means of a decomposed matter, after autopsies on puerperal cadavers and after visiting sick gravidae, parturients or puerperae, even if the latter are producing a decomposed matter, make these visits without having previously washed their hands with chlorine water and in this fashion communicate to such patients the decomposed matter which, if absorbed, causes childbed fever

In English maternity hospitals are thus prevented all cases of the disease which in German and French lying-in hospitals would originate in puerperal cadavers or in such gravidae, parturients and puerperae, hence the more favorable state of health among the puerperae in the maternity hospitals, in which child-bed fever is regarded as contagious Chiari, in an instructive argument in the weekly "Zeitschrift der k k (p 148) Gesellschaft der Aerzte zu Wien," V I, February 19, 1855, No 8, asserts that from these sources the decomposed matter for many diseases can come

HINTS FOR THE PREVENTION OF PUERPERAL EPIDEMICS By the late Professor Chiari

"I take the liberty to direct attention to a subject which, however often discussed, nevertheless requires more explanation This subject is the origin and prevention of the so-called Puerperal Epidemics I say so-called, because it has been established, that diseases of that sort do not spread simultaneously in great numbers over a large district, but, as is well known, occur as a rule only in lying-in hospitals, and even there, appear unevenly distributed in the different departments of the same institution.

"I shall not revert here to the different opinions on the actuating cause of this truly dreadful disease, but shall only permit myself to give a few observations on the causes of the numerous diseases among puerperae, which I made during my term of official service in Prague

"From the 23rd to the 27th of January, 1853, there was observed in a primipara a prolonged labor over the period of time just stated, caused by a thickening of the cervix, with subsequent gangrene. After baths, douches, antiphlogistics, incision of the cartilaginous cervix, swollen to the thickness of a finger, had been tried in vain, embryotomy was undertaken on the already dead infant, in order to accomplish delivery. The discharge from the vagina for the latter two days was dark-brownish, discolored and extremely foul-smelling. The puerpera was ill of a severe Endometritis septica and succumbed to this disease on February i. During the time that this parturient was in the labor room, nine other parturients became ill, who had been (p. 149) in the room with her, and with a single exception, they all died. From the last day of January, this disease recurred frequently until the last of May, and from then until October a most favorable state of health prevailed among the puerperae.

From this I am positively convinced that, in this concrete case, the cause of the repeated illnesses was due to the transfer of the gangrenous matter from the sick parturient to the healthy ones Naturally, in such situations the greatest possible caution should be used, in order not to transfer the deleterious matter by examinations, nevertheless, with such a diseased patient and several healthy parturients simultaneously present in one and the same not too roomy space, the transfer of pathogenic matter is to be taken for granted. But if several cases of the disease appear, then it is conceivable that the persistence of this disease is inevi-

table in an institution, where the space for so large a number of births is scarcely sufficient

"In what I have said up to now, I do not wish to assert, that all so-called puerperal epidemics must originate in this manner, but I do wish to call attention to a condition which can and does frequently occur in the large lying-in hospitals

"As supporting evidence for this view of mine, I had another tragic experience. In October, 1853, several days before my return to Prague after a vacation trip, perforation was necessary in a patient in labor for several days because of contracted pelvis. She died from Endometritis septica, with necrosis of the synchondrosis. After this, several virulent cases of disease appeared, which ceased again the middle of November. From then on to the end of my tour of duty in Prague, (p. 150) i.e. the end of August of the past year, I was happy not to observe any more cases of this dreadful disease, so frequently seen in the clinic there.

"By these two observations I do not wish to demonstrate anything further than that it would be a matter of very great interest to be able now and then to demonstrate the manner of origin of the numerous cases of illness in lying-in hospitals

"Moreover, this manner of origin has already been pointed out by Semmelweis, and in the local clinic for midwives a similar observation was made this fall, as my friend, Dr Spaeth, has told me in a private communication

"I deem it a matter of conscience to publish these observations, even if I did not wish to say that this is the only manner of origin, because the observation of the considerations lying therein could gain thereby a greater practical advantage for the erection and arrangement of the future lying-in hospitals. I consider it an urgent necessity to hold in readiness in the larger maternity hospitals several birth-rooms for the isolation of cases of protracted labor. That this isolation should also be observed in imparting instruction is self-evident.

"Proceeding from the opinion expressed above, that the extension of puerperal diseases in the larger maternity hospitals depends upon the transfer of putrescent deleterious matter, I have

sought to avoid this cause as far as possible and accordingly I have made the following rules for the institution under my direction.

- "I I so divided the instruction that the individual parturents would never be examined by more than five students, after which each student was obliged to wash his hands with chloride of lime solution
- (p 151) "2. In order that the candidate might not easily come to the clinic from his anatomical work, I fixed for the summer and the winter the morning hours from 7 to 9 for holding the clinic.
- "3. I made it my business to see about the careful washing of the linen, and during the second epidemic, arrangements were made that the vulvar compresses themselves would be washed outside the hospital
- "4 Further it seems very easily conceivable that, if one of the puerperae suffers from a puerperal ulcer, this condition could also be communicated to other puerperae by the practice of washing the genitals with sponges. For this reason, I arranged that no sponges were to be used for cleaning the genitals, but only syringes were to be used, since the former come easily in contact with the genitalia, while it is not so easily possible with the latter.
- "5 I sought to isolate the more seriously ill patients from the lying-in hospital, by transferring them into the general hospital. This measure was also necessary because of lack of room. That it is, at any rate, useful in a physical and moral sense to decrease the number of such sick patients in the lying-in hospital must be evident to everyone
- "6 From the views expressed above, it follows also that, in case of the appearance of numerous cases of disease in a lying-in hospital, a change of location as well as of all the furniture of the hospital would be a measure to be preferred, in order to prevent the spread of the disease

"Hence it seems desirable to me in the erection of such an institution to so arrange the structure that every obstetrical clinic (p 152) should have its own building, along with a laundry, entirely separate from the other clinics

"With the application of these measures, as far as it was possible for me to carry them out, the more common puerperal diseases stopped after one or two months, so I think that they may be recommended as urgent"

From these observations of Chiari, the reader may see how the decomposed matter, which comes from a diseased parturient or puerpera, can cause numerous cases of illness. That the decomposed matter which sick parturients and puerperae engender is not the only source of the so-called puerperal epidemics, follows from what has been said of the sources from which the decomposed matter is derived and from which proceed all the so-called puerperal epidemics observed up to now and likely yet to be observed

That actually a better state of health among the puerperae exists in the lying-in hospitals in which childbed fever is considered contagious, and in which chlorine washings are used with the idea of destroying the Contagium, is apparent from a report by Prof Dr Levy of Copenhagen on the lying-in hospitals in London and Dublin, published in the "Bibliothek for Laeger" Prof G A Michaelis in Kiel has published a German translation of this report in the "Neuen Zeitschrift für Geburtskunde," v 27, No 3, p 392

I cannot forbear to print here the preface of the literal translation of this report:

(p 153) "On a trip which I made a short while ago, I had the opportunity to convince myself of the truth of the account in the forelying report, a conviction, which must be forced indeed upon every reader by the diligence and thoroughness of the report

"The main object of the author's inquiry was the investigation of conditions under which puerperal fever appeared, and the means which had been successfully applied to its conquest. The English institutions, above all, offer on this point the most important results, for in most cases they have been terribly stricken from time to time by this pest of lying-in hospitals, but in the last decade their sanitary regulations have fortunately been so successful up to now, that the mortality of the puerperae in all London and Dublin institutions has only just exceeded one per cent. "Unfortunately on the Continent, we are far removed from such happy results With the exception of some of the smaller hitherto untouched institutions, the disease, it seems, rages ever more frequently and lethally with the age of the institution. It threatens already the existence of lying-in hospitals so necessary for the growth of science and practical instruction. Unfortunately this has been the case in the institution under my direction, and according to reports, it appears to be the same in Copenhagen. In both places, it would be necessary to erect new buildings, and if the government grants the necessary means at such a time as this, then a repetition of failures will almost necessarily follow the suppression of the lying-in hospital

"This imminent danger hangs not only over us, but in time it will overtake all similar institutions, in which the restoration

of better health conditions does not succeed

"In places where up to now popular opinion has been indifferent to the fearful sacrifice of human life, with progressive education and an increase in humane feeling, (p 154) public sentiment will one day be mightily outraged and is moreover wholly certain of its victory, the lying-in hospitals must be destroyed or made sound. For the welfare and honor of science, coercion is not desirable, rather one should lay his hand to the work, before the popular rage throws them, destroyed, into the discard.

"I need not prove to one experienced in such matters, that the extermination of the plague is not to be expected through the therapeutic management of the single cases of the disease. On the contrary, this is to be attained only by the thorough and energetic application of measures for the maintenance of cleanliness and ventilation, etc., and the experience of the English shows

it to be certainly attainable in this fashion

"We should consider ourselves obligated to our colleagues in England for this example of efforts crowned by success, for this assured hope of a brighter future, we cannot do better than to inform ourselves by personal observation of their splendid establishments

"These institutions were shown to me with the greatest kindness, and with such an "Open! Sesame" as Professor Levy's

letter, it is possible to attain by personal observation a complete understanding of the English hospitals even in a short time

"In recent years, the happy discovery was made in Vienna, that, by a cleansing of the hands with chloine before the examination, the disease could be restricted in anr extraordinary fashion to the division of the lying-in hospital, where it had raged fearfully up to that time During the time in which this remedy was used, the number of deaths dropped almost to one-tenth of what they had been previously, an extremely brilliant result

"No doubt Dr Semmelweis, to whom we are grateful for this discovery, will publish the details on this matter very soon, if we are not deceived, (p 155) a more hopeful period is coming for our lying-in hospitals through the use of this remedy, along with the general methods of disinfection. For the knowledge of the Vienna discovery, I am indebted to the kind communication of Dr Hermann Schwartz of Holstein, whom I cannot forbear to thank publicly for the favor

Kiel, April 17, 1848"

The statistical report of the London lying-in hospitals, according to Dr Lefy, is as in tables XXV, XXVI and XXVII

The last four years are taken from Arneth's book * Of the year 1848, Arneth says, "I regret, (p 160) that I am not in a position to state what the mortality was in the other institutions in London in the year 1848, which in this lying-in hospital exacted many victims"

Incidentally it may be noted that Mrs Widgen, the clever as well as experienced midwife of the institution under discussion, pointed out an established section in the house as a starting point for the contagion, without my having volunteered such an opinion

(p 161) Of the state of health among the puerperae in this lying-in hospital, Professor Dr Levy says the following

"The change in the health conditions in the hospital in the last $3\frac{1}{2}$ years is so remarkable that it should be interesting to become somewhat more closely acquainted with the efforts and

^{*} Ueber Geburtshilfe und Gynaecologie in Frankreich, Grossbritannien und Irland Wien, 1853

Medical Classics

TABLE XXV

Births and deaths in the British Lying-in Hospital in London from the establishment of the Hospital in November, 1749, to December, 1846

Year	Births	Deaths	%	Mort Rate
1749	3			(Nov to 31 Dec)
1750	175	3	1 71	1)
1751	337	12	3 25	11
1752	433	14	3 23	
1753	284	10	3 52	78 deaths out
1754	321	12	3 73	of 3292 or
1755	370	9	2 43	1 in 42 16/78
1756	370	3	0 81	I I
¹ 757	478	7	1 46	1
1758	521	8	I 53	J
1759	472	6	1 27)
1760	427	26	6 08]]
1761	390	12	3 07	
1762	397	7	1 76	94 deaths out of
1763	414	10	2 41	4773 cases or
1764	366	7	1 91	I in 50 73/94
1765	560	9	1 60	1 111 30 /3/94
1766	588	10	1 70]]
176 7	57 ¹	4	o 70	11
1768	588	3	0 51	ĮJ
1769	561	7	1 24	h
1770	472	28	5 93	li .
1771	541	4	0 73]]
1772	596	4	0 67	106 deaths out of
1773	627	4	0 63	5637 or 1 in
1774	553	18	3 25	53 10/106
1775	570	21	J 3 66	33 10,100
1776	543	3	0 55	
1777	602	6	0 99]
1778	572	11	1 92)
1 7 79	563	3	o 53	h
1780	566	8	I 4I	
1781	524	14	2 67	[[
1782	549	13	2 34	91 deaths out of
1783	587	5	0 85	5513 or 1 in
1784	550	14	2 54	60 53/91
1785	435	6	1 37	1 20 33/9
1786	597	9	1 52	
1787	564	9	1 59	
1788	578	10	I 73	J

TABLE XXV—Continued

Year	Births	Deaths	%	Mort Rate
1789	599	I	0 16)
1790	622	7	1 12	
1791	621	I	0 16	
1792	610	ī	0 16	21 deaths out of
1793	590	I	0 16	6047 or 1 in
1794	581	2	0 34	288 1/21
1795	612	2	0 32	200 1/21
1796	627	I	0 15	
1797	619	3	0 48	
1798	566	2	o 37)
1799	521	I	0 19	
1800	417			li
1801	401	3	0 74	
1802	358	2	0 55	16 deaths out of
1803	366	5	1 36	3702 or 1 in
1804	343	2	0 58	231 6/16
1805	328	I	0 30	231 0/10
1806	323	2	0 61	
1807	321			
1808	324)
1809	310	I	0 32	
1810	329	2	o 6o	
1811	346			
1812	320	2	0 62	12 deaths out of
1813	373			3289 or 1 in
1814	311			274 1/12
1815	349	2	0 57	2/4 1/12
1816	321	3	0 93	
1817	329	I	0 30	
1818	301	I	0 33	<u> </u>
1819	292			
1820	299	2	o 66	
1821	262	I	0 08	
1822	180	7	3 88	30 deaths out of
1823	163	5	3 06	2052 or 1 in
1824	176			68 12/30
1825	170	4	2 35	1 00 12/30
1826	183	2	1 09	
1827	159	6	3 72	11
1828	168	3	1 78	}

Medical Classics

TABLE XXV-Concluded

Year	Births	Deaths	%	Mort Rate
1829	156	7	4 48	1
1830	85	I	1 17	
1831	142	ı	0 77	
1832	117	7	5 98	and and a control
1833	122	I	0 45	30 deaths out of
1834	113	3	2 65	1178 or 1 in
1835	108	3 3	2 77	39 8/30
1836	89			
1837	104	2	1 92	
1838	142	5	3 52)
1839	104)
1840	113	1	0 38	11
1841	125	3	2 40	12 deaths out of
1842	106			13
1843	106	3	2 83	876 or 1 in
1844	117	I	0 85	73
1845	94	3	3 19	
1846	111	I	0 90	ĮJ
98 years	36337	490	I 34	

In 12 years no deaths out of 2862 puerperae	
In 39 years 84 deaths out of 16692 puerperae	0 49%
In 21 years 137 deaths out of 8956 puerperae	I 52
In 10 years 76 deaths out of 3029 puerperae	2 50
In 12 years 125 deaths out of 3626 puerperae	3 44
In 1 year 7 deaths out of 156 puerperae	4 48
In 2 years 35 deaths out of 589 puerperae	5 94
In 1 year 26 deaths out of 427 puerperae	6 o8

experiments, which have previously been made for this purpose, and in the familiar "Health of town's commission's first report," v 1, pp 117–121, an authoritative explanation is found. It may be seen therein, that, up to 1838, the usual palliative measures against hospital epidemics (endemics—The author) were considered satisfactory. But if one now glances around the hospital buildings, it can be seen that, in the immediate vicinity of the building and scarcely 30 feet from the walls, there are open trenches over 1500 feet in length, which receive the sewage from the neighboring, poor and closely crowded sections of the city

The contents of the trenches were stagnant, and in constant ebullition as a result of the constant formation of gas

"After numerous difficulties and many debates with the Water-works Commission, the hospital board of directors in October, 1838, finally succeeded, in return for financial assistance with the heavy costs, in having a 644 foot-long stretch of the trench cleaned and roofed over, but the blunder was made of

TABLE XXVI
Queen Charlotte's L I H

Year	Births	Deaths	%
1828	265	10	3 77
1829	221	6	2 71
1830	236	6	1 69
1831	207	4	1 93
1832	217	2	0 92
1833	130		
1834	161	2	1 24
1835	214	I	0 47
1836	169	2	1 18
1837	215	2	0 93
1838	202	5	2 47
1839	204	4	1 96
1840	199	3	1 50
1841	218	3	¹ 37
1842	212	2	0 94
15 years	3070	52	1 69

In 1 year no deaths out of 130 puerperae	
In 4 years 7 deaths out of 858 puerperae	o 81%
In 7 years 24 deaths out of 1394 puerperae	I 72
In 2 years 11 deaths out of 423 puerperae	2 60
In 1 year 10 deaths out of 265 puerperae	3 77

spreading an enormous quantity of black slime over the adjoining ground, so that the evaporating surface was immediately very much increased. Dr Rigby believed that, as a probably immediate effect of this, inside of the first 24 hours after this inexcusable blunder, two cases of puerperal fever appeared in the hospital, which for some time before had been entirely free from the disease. There was no noticeable effect upon the state of

health (p 162) in the hospital, and accordingly Dr. Reid was permitted to install his heating and ventilating apparatus, be-

(p 159)

TABLE XXVII

III. The City of London L I H

Year	Births	Deaths	%
1827	317		
1828	312		
1829	377		
1830	236	15	6 35
(Cl	osed)		
1831	363	5	I 37
1832	404	5 3	o 76
1833	330	I	0 30
1834	411	3	0 72
1835	473	7	1 48
1836	437	8	ı 83
1837	522	7	1 34
1838	600	13	2 16
1839	565	10	1 76
1840	590	6	1 01
1841	635	6	0 94
1842	567	1	0 17
1843	489	2	0 40
1844	466	4	0 85
1845	382	6	1 56
1846	467	7	I 49
1847	554	7	ı 26
1848	547	27	4 93
1849	448	14	3 14
1850	376	2	o 53
24 years	10868	154	1 43
In 2 years no deaths	out of 1006 puerperae		
	out of 3678 puerperae		0 59%
	out of 4353 puerperae		I 44
	out of 600 puerperae		2 16
	out of 448 puerperae		3 14
	out of 547 puerperae		4 93
	out of 236 puerperae		6 35_

cause the hospital physicians were complaining of the faulty ventilation of the wards

[&]quot;As already stated, there were no immediate results, since

childbed fever still dispatched several victims in the last months of 1842 and in the beginning of 1843. According to Dr Rigby's conviction, the reason for this would be found only in the malevolent opposition, which the new ventilating system had encountered in the whole female attending personnel. The female

TABLE XXVIII

IV The General Lying-in Hospital

Year	Births	Deaths	%
1829	170	7	4 09
1830	183	3	1 63
1831	160	2	1 25
1832	180	2	1 11
1833	184	6	3 26
1834	209	7	3 34
1835	185	14	7 67
1836	212	9	4 24
1837	196	4	2 04
1838	71	19	26 76
1839	171	6	3 50
1840	210	15	7 14
1841	117	15	12 82
1842	153	11	7 18
1843	191	2	1 04
1844	166		j
1845	186]	
1846	208		
18 years	3152	122	3 87

In 3 years no deaths out of 560 puerperae	
In 4 years 9 deaths out of 714 puerperae	I 26%
In 1 year 4 deaths out of 196 puerperae	2 04
In 3 years 19 deaths out of 564 puerperae	3 3 6
In 2 years 16 deaths out of 382 puerperae	4 28
In 3 years 40 deaths out of 548 puerperae	7 29
In 1 year 15 deaths out of 117 puerperae	12 82
In 1 year 19 deaths out of 71 puerperae	26 76

attendants were restrained only with the greatest difficulty, and not always successfully, from preventing all ventilation in the wards by the untimely closing of the valves He also believed that only after the discharge of a part of this personnel and the employment of some trustworthy candidates for supervision of

all orders which would be given in regard to the ventilation, would the full effect of the apparatus be perceptible, and indeed to such an extent that he ascribes to the improved ventilation alone the remarkable change in the state of health in the hospital which occurred in the spring of 1843.

"Unfortunately, there were still doubts about the matter, because something happened during this same period which was attributed to a great influence from another source. Early in 1843, Dr. Reid noticed that a foul-smelling fluid repeatedly rose up from the base of the cellar-vaults, where the hearth of the chimney-flues was placed, and after examination of the water, it was concluded that it must have come from the nearby sewer conduit. For this reason, all sewer-outlets were inspected. A main drain was then found to be so tightly stopped with some pieces of wood, that a strong suspicion prevailed that malice rather than accident might be to blame, in addition, (p. 163) the whole surrounding area of the cellar-soil was found to be overflown and saturated by all sorts of stinking ordure, without it being possible to determine in any conceivable manner, how long this condition had already existed.

"Since the discovery and removal of these miasmatic sources took place along with the more strict use of the new ventilating apparatus, it is natural that the opinions should be divergent and that it should be difficult to determine to which factor one should ascribe the actual contribution to the favorable state of health in the hospital, lately so much improved As has been said, Dr Rigby believes in the ventilation and considers the other circumstance as less important, for he denies any trace of cellar moisture outside the vault on the site of the building, where it was discovered, and in addition, considers the description of the cellar soil referred to as very much exaggerated Others, on the contrary, who do not take into consideration the interference with the ventilating system by the personnel in the first period, lay particular stress on the argument, that it had been in use nearly a year, without preventing the epidemic (endemic-Author) appearance of the fever Moreover it may be added that the other previously named and well-situated London institutions,

4 103/
- Motors TARY-
Year Mothers Death TABLE XXIX
Mothers Deaths Dublin (Rev. 1)
75/ SS Volunda) L I II
175- 454 1 87 -10thers 7
759 406 ° 176 1804 Seaths c
1 556 3 1 00 1805 3-3 16
1 505 1 7 1 - 11 1006 1 - 1 1 1 1 1 1
$\frac{1763}{1800} = \frac{333}{6} = \frac{172}{1800} = \frac{1800}{1800} = \frac{2511}{1800} = \frac{23}{1800} = \frac{34}{1800} = \frac{34}{180$
1764 400 9 112 2666 12 93
1765 12 184 183 2880 13 07
$\frac{1700}{181}$ $\frac{181}{681}$ $\frac{181}{181}$ $\frac{181}{181}$ $\frac{181}{181}$ $\frac{181}{181}$ $\frac{181}{181}$
1769 664 3 0 14 1812 2561 24 1 01
176 655 11 165 1813 20/6 12 0.93
1770 642 0 2 44 1814 444 62 160
1771 670 8 1 24 1015 3075 25 249
$\frac{1772}{772}$ $\frac{095}{79}$ $\frac{1}{5}$ $\frac{1}{19}$ $\frac{2016}{182}$ $\frac{3314}{3314}$ $\frac{17}{7}$ $\frac{99}{9}$
1773 6-4 4 71 18-0 3473 18 0.5
$\frac{1774}{100} = \frac{34}{687} = \frac{13}{13} = \frac{36}{100} = \frac{1810}{1810} = \frac{3539}{100} = \frac{32}{100} = \frac{34}{100} = \frac{34}{100}$
1776 728 21 3 08 1820 3197 24 1 58
$\frac{770}{1770}$ 802 5 0 68 1821 $\frac{2458}{20}$ 70 2 94
1778 835 0 87 1822 1849 22 2 84
$\frac{1779}{179}$ $\frac{927}{10}$ $\frac{1}{10}$ $\frac{1}{10}$ $\frac{1823}{10}$ $\frac{173}{2584}$ $\frac{12}{12}$ $\frac{0}{12}$
1780 2011 0 1 07 2024 2006 50 44
$\frac{1781}{1027}$ $\frac{1}{5}$ $\frac{0.79}{1826}$ $\frac{2740}{2740}$ $\frac{20}{1000}$ $\frac{0.81}{1000}$
1/02 900 6 0.35 1827 2440 20 0.94
1703 1167 6 0 30 1828 2550 01 3 33
178, 1261 13 1 28 1829 2030 42 1 29
1786 1292 1 0 87 1830 141 34 1 50
1787 331 8 0 61 331 2176 12 39
1788 1347 10 0.59 1332 2242 12 132
1/09 1 9 22 0/4 1000 2128 12 25
1/90 1/30 1/2 2024 1/2 2024
1791 1602 12 174 1836 1902 34 167
1702 1631 25 17 1837 1810 34 1.78
170 1747 0.6 1838 33 0 1.98
170, 1 1543 1 100 1030 1 1 30
1796 1503 7 1 29 1840 1521 25 2 11
199 1712 10 40 18 2003 20 1 72
190 12 01 10 2171 23 1
1800 1537 8 0 1844 2210 0 96
1801 1837 10 65 1845 1208 1. 0.99
$\frac{1802}{1}$ $\frac{1725}{1}$ $\frac{1846}{1}$ $\frac{1846}{1}$ $\frac{1711}{1}$ $\frac{1846}{1}$
802 1985 30 174 1847 2025 17 2 48
2028 20 1848 2703 683
98 years, 159,749 puerperae, 1966 deaths, 1 23%
cars 790 denal of 8, og 1966 dearba
cars 48, de tins out of 50,505 puerperae

In 46	98 years v		2063
In 35 10 15 590 d	98 years, 159,749 pu eaths out of 84,985 puer eaths out of 52,465	erperae	
In 10 3 cars 790 d	eathe out of 84,085 per	, 1966 dea	the rea
In a cars 484 de	out of care	rperae	

In 35 Very 590 deaths	/ I 8 ₄
In 35 years 790 deaths out of 84,985 puerperae, 1966 deaths, 1 23% In 2 years 484 deaths out of 52,400 puerperae	
In 35 years 790 deaths out of 84,985 puerperae In 10 years 484 deaths out of 19,234 puerperae In 2 years 102 deaths out of 3,121 puerperae	
deaths out of 3,234 Puerperae	0 ()
3,121 Puerperae	0 69%
	2 52
477	3 26

without artificial ventilating systems and even with less favorable room space, in the course of the year have shown a very good state of health on the whole, but, on the other hand, it may not be overlooked that even if the nearest and worst source of disease is checked, still several others of the same kind show themselves in the low and swampy surroundings of the hospital, such as the still present, foul-smelling trench not far distant, and that accordingly the state of health was so very much changed Yet

TABLE XXX

Coombe Lying-in Hospital

7.8 12				
Year	Mothers	Deaths	%	
1833	413	5	I 2I	
1834	432	3	0 69	
1835	430	3	0 69	
1836	513	9	1 75	
1837	426	5	1 17	
1838	501	14	2 79	
1839	306	9	2 94	
1840	429	I	0 23	
1841	511	5	0 97	
1842	427	3	0 70	
1843	347	2	o 57	
1844	355	6	1 69	
1845	417	4	0 95	
1846	450	2	0 44	
13 years	5957	71	1 19	

In 8 years 23 deaths out of 3443 puerperae 0 66%
In 4 years 25 deaths out of 1707 puerperae 1 46
In 2 years 23 deaths out of 807 puerperae 2 85

such significance is ascribed to the last named unfavorable conditions as a cause of the catastrophe of 1842, (p 164) that the just mentioned Dr Fergusson in 1839 in his well-known paper on childbed fever (p 104) says. "As to the General Lying-in Hospital, its unhealthiness is attributed to its location almost below the tide-level, surrounded by a network of open trenches of 1500 feet in length, which receive all the impurities of the Lambeth district, and some of these lie not 30 feet away from the walls of the building"

(To be continued)



MEDICAL CLASSICS

Compiled by

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NO. 6



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NO. 6



The Etiology, the Concept and the Prophylaxis of Childbed Fever. II

BY

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Pest, Vienna and Leipzig
C A Hartleben's Verlags-Expedition

1861

Translation By Frank P Murphy, AM, MD
Associate Professor of Obstetrics, Creighton University School of Medicine

HETHER the health conditions among the puerperae in this lying-in hospital are improved to the extent that, through a suitably applied ventilating system, the deleterious matter, which formerly developed as a result of bad ventilation, will not develop any more, or whether the

state of health will be better because, through cleaning and covering over the trenches, no more harmful matter can be conveyed to the lying-in hospital, is rather a matter of indifference for our present purpose, for us, in both cases, it is a proof that the increased mortality in this lying-in hospital also is not dependent on at-

mospheric-cosmic-telluric influences, but was caused by the introduction of harmful matter

WESTERN LYING-IN HOSPITAL

Of this lying-in hospital, Professor Dr Levy says the following. "Proportionately smaller and excellently equipped for practical instruction, the Lying-in Hospital, formerly called the Western, was established about 12 years ago in a small private house on Arrau-Quai The institution, which Dr Churchill directs, was maintained alone by charity, while the students pay for instruction, and part of them (five or six) live in the house, part (seven or eight) outside The four poorly furnished (p 168) rooms, each with four beds, admit each year about 120 parturients, but in addition each year, with the help of the students, the institution cares for about 600 parturients in their homes The teaching is carried on in much the same fashion as in the Coombe Hospital, and the state of health seems to be very favorable, because, according to Churchill's report, out of 3211 parturients, which, from the establishment of the hospital down to 1843, were cared for in and outside the hospital, only 15 died, a ratio of 1 to 214 puerperae, or 0.46%: as to the different ratios within and outside the hospital, there is no separate statement

"The smaller Anglesea and Victoria foundations are not important enough to claim wider attention"

THE LYING-IN HOSPITAL IN EDINBURGH

From 1823 to 1837, 2890 deliveries took place in this maternity

hospital, of which 36 died of childbed fever, or I 24%

We have presented to the reader eight hospitals from three different countries, in seven, the mortality was just over 1%, in the eighth, it was 3% For this greater mortality, we find the etiologic factor, not in atmospheric influences, but in the deleterious matter from the drainage canals which surround this hospital

Wherein lies the reason that the atmospheric influences so strikingly spare the puerperae in the united three kingdoms which, in German and French lying-in hospitals, carry off the puerperae in such great numbers?

The reason is found in the fact that it is not an atmospheric

influence to which the puerperae in the German and French hospitals fall victims in such large numbers, (p 169) but that it is a decomposed animal-organic matter which, introduced into the individual from without, produces the mortality in the three kingdoms and in the German and French lying-in hospitals, only, because of conditions in the German and French lying-in hospitals, the decomposed matter is introduced from without into individuals in these hospitals much more often, and consequently the greater mortality. In the three kingdoms, a decomposed matter is conveyed to the individual much less often and on that account the mortality is much smaller.

The English believe childbed fever to be contagious, use chlorine washings and thereby destroy the decomposed matter, which is derived from diseased gravidae, parturients, puerperae and puerperal cadavers. In German and French lying-in hospitals, where it is not destroyed, it causes many cases of illness, as Chiari has shown us.

In German and French lying-in hospitals, the decomposed matter is very frequently derived from diseased patients and from cadavers, either of which may not have been affected by childbed fever, for that reason, because these hospitals as a rule are connected with large general hospitals, the students are sometimes busy in the dead-house, sometimes in the maternity hospital, and sometimes in a surgical or medical division, and accordingly become carriers of decomposed matter, which is the origin of so much misfortune in the lying-in hospital

The lying-in hospitals in the three kingdoms are all independent institutions, and because of the separation from the general hospital, the student is forced to occupy himself only with midwifery

If the favorable state of health in the London lying-in hospitals may be attributed to the fact that there never were more than two students under instruction, then allow me to remark that a student (p 170) in that case is certainly not an atmospheric influence, and that childbed fever, carried by the hands of the students, contaminated with decomposed matter, is therefore not an epidemic childbed fever.

That it is not a matter of indifference, whether a few or many

students examine with hands contaminated with decomposed matter, is obvious, but it is wholly a matter of indifference, whether many or few students examine with clean hands. That it does not depend upon the number but the cleanliness of the examining hands, the results of the Dublin Lying-in Hospital proves, of which Levy says. ".. but a practical school has been maintained, where, in the course of time, several thousand young physicians from all parts of England have gone in quest of practical training in midwifery, and lastly, it has been completely demonstrated to the whole world, that it is a superstition born of discouragement, when, with no regard for the necessities of education and science, one says that a horrible mortality is one of the unavoidable characteristics of the larger lying-in hospitals"

That it is not the number but the cleanliness of the examining hands that matters, is proved by the First Clinic in Vienna where, in the month of April, 1847, before the chlorine washings and with 20 students examining, 57 out of 312 puerperae died, or 18.27%, while in the year 1848 with 42 students in attendance, 45 out of 3556 puerpera died, or 1.27%

In order to make very plain to the eyes of the reader the difference in the mortality ratios between lying-in hospitals, in which a decomposed matter is rarely introduced into the individual from without, and those in which it occurs frequently, we shall compare the numerical report for 66 years in the Dublin and the Vienna lying-in hospitals Both are teaching hospitals for physicians

The same difference in mortality is found in a comparison between the Dublin Lying-in Hospital and the Maternité in Paris, as Table No XXXII shows

(p 175) That the mortality among the puerperae of the Maternité before the period which these figures represent was a significant one is evident from Osiander's work previously quoted. On p 51, he says, "From December 9, 1797 to May 31, 1809, 17,308 women were delivered, 2000 puerperae, at least, were seriously ill, and 700 died and were autopsied, a mortality of 404%"

On p 242, he says, "The abdominal inflammation, the malady which is usually designated with the name "puerperal fever,"

(p 171)

TABLE XXXI

y -7-7							
Year		Oublin L I.H		Vienna L I H (pre-anatomic)			
	Mothers	Deaths	%	Mothers	Deaths	5,0	
1784	1261	II	0 87	284	6	2 11	
1785	1292	8	0 61	899	13	1.44	
1786	1351	8	0 59	1151	5	0 43	
1787	1347	10	0 74	1407	5	0 35	
1788	1469	2 3	1 56	1425	5	0 35	
1789	1435	25	1 74	1246	7	0 56	
1790	1546	12	o 77	1326	10	0 75	
1791	1602	25	1 56	1395	8	0 57	
1792	1631	10	0 61	1579	14	o 89	
1793	1747	19	80.1	1684	44	2 61	
1794	1543	20	1 29	1768	7	0 39	
1795	1503	7	0 46	1798	38	2 11	
1796	1621	10	0 61	1904	22	1 16	
1797	1712	13	0 75	2012	5	0 24	
1798	1604	8	0 49	2016	5	0 24	
1799	¹ 537	10	0 65	2067	20	0 96	
1800	1837	18	0 97	2070	41	1 98	
1801	1725	30	I 74	2106	17	080	
1802	1985	26	1 30	2346	و	0 38	
1803	2028	44	2 16	2215	16	0.72	
180_	1915	16	o 83	2022	8	0 39	
1805	2220	12	0 54	2112	9	0 40	
1806	2406	23	0 95	1875	13	o 73	
1807	2511	12	0 47	925	6	0 64	
1808	2665	13	0 48	855	7	0 81	
1809	2889	21	0 72	912	13	I 42	
1810	2854	29	1 01	744	6	0 80	
1811	2561	24	0 93	1050	20	1.90	
1812	2676	43	160	1419	9	0 63	
1813	2484	62	2 49	1945	21	30 I	
1814	2508	25	0 99	2062	66	3 20	
1815	3075	17	0 55	2591	19	0 73	
1816	3314	18	0 54	2410	12	0 49	
1817	3-73	32	0 92	2735	25	0 91	
1818	3539	56	1 58	2568	56	2 18	
1819	3197	94	2 94	3089	154	98 ہے	
1820	2458	70	2 84	2998	75	2 50	
1821	2849	22	0 77	3294	55	1 66	
1822	2675	12	0 44	3066	26	0 84	
			·		<u> </u>		

Medical Classics

TABLE XXXI-Continued

Vac] 1	Dublin L I H			Vienna L I H (pre-anatomic)		
Year	Mothers	Deaths	%	Mothers	Deaths	%	
				Medicine i basis	n Vienna	on anatomic	
1823	2584	59	2 28	2872	214	7 45	
1824	2446	20	0 81	2911	144	4 98	
1825	2740	26	0 64	2594	229	8 82	
1826	2440	81	3 33	2359	192	8 12	
1827	2550	33	I 29	2367	51	2 15	
1828	2856	43	1 50	2833	101	3 56	
1829	2141	34	1 59	3912	140	4 64	
1830	2288	12	0 52	2797	111	3 97	
1831	2176	12	0 55	3353	222	6 62	
1832	2242	12	0 53	3331	105	3 15	
				Ist Dio	LIH int Clinic for m l midwives	ed students	
1833	2138	12	0 57	3737	197	5 29	
1834	2024	34	1 67	2657	205	7 71	
1835	1902	34	1 78	2573	143	5 55	
1836	1810	36	1 98	2677	200	7 47	
1837	1833	24	1 30	2765	251	9 09	
1838	2126	45	2 11	2987	91	3 04	
1839	1951	25	1 23	2781	151	5 04	
1840	1521	26	1 70	2889	267	9 05	
			!	1st Div C. alone	linic for me	ed students	
1841	2003	23	1 14	3036	² 37	7 07	
1842	2171	21	0 96	3287	518	15 08	
1843	2210	22	0 99	3060	274	8 09	
1844	2288	14	0 61	3157	260	8 02	
1845	1411	35	2 48	3492	241	6 o8	
1846	2025	17	0 83	4010	459	11 04	
				Introduction May, 1847	of chlorine , in 1st Div	washings in	
1847	1703	47	2 75	3490	176	5 00	
1848	1816	35	1 92	3556	45	1 27	
1849	2063	38	1 84	3858	103	2 06	
6 years	141,903	1,758	1 21	153,841	6,224	4 04	

TABLE XXXI-Concluded

(p 173) In Vienna L I H the mortality was

Years	%	Mothers	Deaths	%
25	0	44,843	273	0 60
8	1	15,630	230	1 48
7	2	15,557	373	2 39
5	3	14,010	484	3 45
3	4	9,012	438	4 86
4	5	12,581	667	5 30
2	6	6,845	463	6 77
4	7	11,242	856	7 61
4	8	11,170	955	8 54
2	9	5,654	518	9 12
ı	II	4,010	459	11 04
I	15	3,287	518	15 08

In 66 years Mothers 153,841, Deaths 6,224, 404%

In Dublin L I H the mortality was

Years	%	Mothers	Deaths	%
35	0	76,427	540	0 70
22	1	45,045	681	1 51
8	2	17,991	456	2 53
1	3	2,440	81	3 33

In 66 years Mothers 141,903, Deaths 1758, 1 21%

and tends to be endemic in all large and over-crowded lying-in hospitals, appeared also in the lying-in hospital at Paris The disease was especially prevalent in the winter months, and although it is continually present, the two years (between 1803 and 1808), when it raged endemically and carried off a multitude of puerperae, are recalled with horror"

I have never been able to learn the exact mortality among the puerperae during these two years, and the cautious writer of the essay on the Maternité* gives no definite figures, but it is evident from everything said thereon, that it must have been very great, especially because, during the five years cited (on account of the two years, in which the abdominal inflammation raged),

^{*}Mémoire sur l'hospice de la Maternité Paris, 1808 The three authors of this article are all connected with The Bureau of Hospitals and are praised by the administration because of care used in preparing the account

(p 174)

TABLE XXXII

Year	Maternité			Dublin L I H		
Icai	Births	Deaths	%	Births	Deaths	%
1828	2920	163	5 58	2856	43	1 50
1829	2788	252	9 03	2141	34	1 59
1830	2693	122	4 45	2288	12	0 52
1831	2907	254	8 73	2176	12	0 55
1832	2582	146	5 65	2242	12	0 53
1833	1833	109	4 20	2138	12	0 56
1834	2629	97	3 68	2024	34	1 67
1835	2632	92	3 49	1902	34	I 88
1836	2586	57	2 20	1810	36	1 98
1837	2829	45	1 59	1833	24	1 30
1838	2983	81	2 71	2126	45	2 11
1839	3407	122	3 58	1951	25	1 23
1840	3701	94	2 53	1521	26	1 70
1841	3515	114	3 24	2003	23	1 14
19 years	58374	2441	4 18	38254	520	I 35

In Maternité of Paris the mortality was

Years	%	Mothers	Deaths	%
1	I	2,829	45	I 59
4	2	12,941	34 ²	2 64
5	3	15,935	558	3 50
5	4	15,472	681	4 50
2	5	5,502	309	5 61
I	8	2,907	254	8 73
I	9	2,788	252	9 03

19 Years Mothers 58,374, Deaths 2441, 4 18%

In Dublin L I H the mortality was

Years	%	Mothers	Deaths	%
6	0	13,157	79	o 6o
10	I	19,857	314	1 58
3	2	5,240	127	2 42

19 Years Mothers 38,254, Deaths 520, 1 35%

the mortality was in a ratio of 1 to 23, while in the other period, it was only 1 to 32 During these 5 years, there were 414 deaths

out of 9,645 women, for the most part from abdominal inflammation, or 429%.

(p 176) This same dissimilarity in mortality, we find in a comparison between the Dublin L I. H and Dubois' clinic, as Table No XXXIII shows

If we sum up the reports of the four London and the two Dublin lying-in hospitals, already presented by the years, then we have the following (p 177) highly important table. Over a period of 262 years in these six lying-in hospitals there were delivered 219,133 women, of whom 2,855 died, or 1 30%. The mortality was as shown by Table No XXXIV.

That the great mortality in the lying-in hospitals was not due to atmospheric influences is proven also by the fact that in cities in which there are several lying-in hospitals, an unfavorable state of health does not appear simultaneously in all of them, what then must be the situation, since several lying-in hospitals in one and the same city could not be subjected at the same time to different atmospheric influences?

In order to make this clear to the reader, we shall compare the five most unfavorable years of the four London lying-in hospitals

Of Dubois' clinic and the Maternité at Paris, Arneth says that during his stay in Paris in 1850, the clinic was closed for a short time on account of the many cases of disease, while in the almost as notoriously unhealthy Maternité there were none to be found.

We have seen in Vienna and Strassburg, that even different divisions of one and the same lying-in hospital can have different mortality ratios

That the large mortality in the lying-in hospital is not caused by atmospheric influences is proven by the fact that the puerperae of the city at large, in which the lying-in hospital harboring the childbed fever is located, are not attacked at the same time in extraordinary numbers, (p 179) although of necessity the lying-in hospital and the place in which the lying-in hospital is located can only be subjected to the same, and not to different, atmospheric influences

That in reality at the time when the puerperae in the lying-in hospital were being decimated by childbed fever, those of the

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TABLE XXXIII

Year	Dubois			Dublin		
Tear	Births	Deaths	%	Births	Deaths	%
1835	264	22	8 33	1902	34	1 78
1836	242	17	7 02	1810	36	1 98
1837	358	31	8 65	1833	24	1 30
1838	516	25	4 84	2126	45	2 11
1839	439	24	5 46	1951	25	I 23
1840	582	26	4 46	1521	26	1 70
1841	596	22	3 69	2003	23	I 14
1842	830	34	4 19	2171	21	0 96
1843	730	39	5 34	2210	22	0 99
1844	903	41	4 54	2288	14	0 61
1845	884	44	4 97	1411	35	2 48
1846	901	42	4 66	2025	17	0 83
1847	1088	31	2 84	1703	47	2 75
1848	940	24	2 56	1816	35	1 92
14 years	9273	422	4 55	26770	404	1 50

In Dubois' Clinic the mortality was

Years	%	Mothers	Deaths	%
2 I	2 3	2,028 596	55 22	2 71 3 69
6	4	4,616	212	4 59
2	5	1,169	63	5 38
I	7	242 622	17	7 02
2	8	622	53	8 52

14 Years Mothers 9,273, Deaths 422, 4 55%

In Dublin L I H the mortality was

Years	%	Mothers	Deaths	%
4	0	8,694	74	0 85
7	I	12,836	203	1 58
3	2	5,240	127	2 42

14 Years Mothers 26,770, Deaths 404, 1 50%

locality referred to were enjoying good health, is indeed proven by the order for closing the lying-in hospital After the hospital was closed, the births certainly did not cease, but took place as usual, throughout the city and still the parturients scattered over the city remained healthy, which defeats the argument for the atmospheric influence over the lying-in hospital in the same

city

Of course, puerperae sometimes died outside the hospitals in rather large numbers, but this greater mortality is not to be attributed to atmospheric influences, because the greater mortality outside the lying-in hospitals did not occur simultaneously with a greater mortality in the hospitals, and because the hospital mortality often attained a height such as never occurred outside, and lastly because such a mortality was observed more rarely outside the hospital

TABLE XXXIV

In	19 years	no deaths out of	4558 puerperae		
			109,656 puerperae	0	67%
		•	69,533 puerperae	I	50
In	26 years	611 deaths out of	24,289 puerperae	2	51
		270 deaths out of		3	36
I_n	4 years	50 deaths out of	1,085 puerperae	4	60
In	2 years	35 deaths out of	589 puerperae	5	94
In	2 years	41 deaths out of	663 puerperae	6	18
In	3 years	40 deaths out of	548 puerperae	7	29
In	1 year	15 deaths out of	117 puerperae	12	82
In	1 year	19 deaths out of	71 puerperae	26	76
_	262 2	,855	219,133	I	30

Childbed fever, outside or inside the hospital, no single case excepted, is a resorption fever in all cases, caused by the absorption of a decomposed animal-organic matter. This decomposed animal-organic matter within or without the hospitals is engendered in rare cases within the individual affected and causes childbed fever by auto-infection. In the overwhelmingly greater number of cases the decomposed animal-organic matter which, when absorbed, produces childbed fever, (p. 180) is communicated to the individual from without, and therefore is caused by infection from without, whether the patient is in the hospital or not

The source of the decomposed matter which causes childbed

fever is the cadaver; within and without the lying-in hospitals, autopsies are done by physicians who practice midwifery. The source of the decomposed matter which causes childbed fever is the sick patient, whose disease produces a decomposed material;

TABLE XXXV

	IIIDEE ZEZET		
	Puerperae	Deaths	%
	1838		
The General	71	19	26 76
British	142	5	3 80
Queen Charlotte	202	5	2 47
City of London	600	13	2 16
	1841		
The General	117	12	12 82
British	125	3	2 40
Queen Charlotte	218	3 6	1 37
City of London	635	6	0 94
	1835		
The General	185	14	7 67
British	108	3	2 77
City of London	473	7	1 48
Queen Charlotte	214	1	0 47
	1840		
General	210	15	7 1
Queen Charlotte	199		1 50
City of London	590	3 6	1 01
British	113	1	0 83
	1842		
General	153	11	7 18
Queen Charlotte	212	2	0 94
City of London	567	I	0 17
British	106		0 00

within and without the lying-in hospital, diseased persons who engender a decomposed matter are treated by physicians who practice midwifery. Within and without the lying-in hospital, physiologic animal-organic products become decomposed because

of improperly observed cleanliness, and thus, within or without the hospitals, are sources of the decomposed matter which engender childbed fever.

The carrier of the decomposed matter which is derived from these three sources, within or without the hospital, is the examining finger, the operating hand Hospital physicians who have contaminated their hands in the hospital by handling cadavers or with decomposed products of the various diseases, examine and operate outside the hospital also Private physicians who have contaminated their hands during autopsies, or with the decomposed products of the various diseases, also practice midwifery.

Midwives frequently care for sick patients whose disease engenders a decomposed matter, e.g. in discharging carcinoma of the uterus they contaminate hands while giving douches for cleanliness' sake, and thus become the carriers of decomposed matter.

Carriers within and without the hospital can be instruments, bed linen, the atmospheric air, etc; in short, all those things, (p 181) which are polluted by decomposed matter and come in contact with the genital organs of the individual

Moreover, since a large number of patients are never infected at the same time inside and outside the lying-in hospital, there never is simultaneously a great mortality among the puerperae within and without the hospital

Since private physicians have opportunity as hospital physicians to contaminate their hands with decomposed matter less often, childbed fever, for that reason, occurs more rarely in great numbers outside the hospital. And finally, because the private physician does not have occasion to examine so many patients in a short time as does the physician in the large lying-in hospitals, childbed fever never occurs in such horrible numbers outside.

The busiest physician is able to care for only a few obstetrical cases daily, while, in the Vienna Lying-in Hospital, we frequently saw 30 to 40 births in 24 hours, so it is conceivable that the finger of the private physician, contaminated with decomposed matter,

cannot carry childbed fever to a large number of patients, as does the finger of the physician in the large lying-in hospital. Thus it happens that the patients outside the lying-in hospital are as a rule examined by only one physician, while within the hospital the patients are examined by several, even to a great number of physicians and medical students, and although a single contaminated finger is sufficient to infect a large number of patients, yet among so many examining fingers it is easier for one or the other to be unclean, than when merely one finger is used in an examination

Arneth, in his previously mentioned book, has published a highly instructive summary of his experiences in England in regard to the production of childbed fever outside (p 182) the lying-in hospital by the transfer of decomposed matter (p. 334).*
"Puerperal fever is such a fearful disease, that it should be of the greatest interest to us to know what the English physicians

"Puerperal fever is such a fearful disease, that it should be of the greatest interest to us to know what the English physicians think of the disease in general, and particularly of that somewhat mysterious detail—its etiology—, and how they treat their patients

"Roberton, a physician of wide experience, classifies the women according to the frequency with which they become ill of puerperal diseases when no epidemic is flourishing, into those who had only family care, and those who had medical care. From his experience, the first group was less frequently affected by puerperal diseases. In the industrial city of Hulme, with approximately 40,000 inhabitants, the number of women who had medical care is exceptionally small. The women of the laboring class, who make up the great majority of the female population, are accustomed to arise at five o'clock in the morning, to send the older children off to work, and should she not accompany her husband to the factory, to look after her housework and her younger children, duties which do not give her an instant's rest from early morning until far into the night. If the children fall ill, her troubles are conceivably greater, during the entire course of pregnancy, even if the first stage of labor is prolonged, and

^{*} Ueber Geburtshilfe und Gynaecologie in Frankreich, Grossbritannien und Irland. Wien, 1853, bei Wilhelm Braumüller

even during this stage, she is busy with her work, until the labor pains, increasing in force, compel her to stop. In spite of these privations, in Hulme, according to the official statistics of the decade 1839-49, there was a ratio of only I in $196\frac{1}{2}$ deaths due to childbed fever. Four (p. 183) other nearby small cities, whose inhabitants belong to a slightly more prosperous class, had I in 84 deaths from childbed fever.

"During an epidemic, the state of affairs is noticeably different, for the poor puerperae, crowded together in a small space with numerous other tenants, frequently succumb, while the well-to-do, who enjoy greater comforts, cleanliness and careful nursing, have a much greater expectation of recovery. The more unfavorable situation of the two previously mentioned classes of society, according to Roberton's opinion, probably also affects the wives of the tradesmen and of the small business men, who live in poorly constructed habitations, yet in spite of better education, effeminacy, and the favored amusements of the higher classes, do not enjoy the privileges which their situation warrants

"A great deal of practical knowledge, which has been acquired in England, and with the most significant of which we shall become more familiar, indicates that puerperal fever occurs after the absorption of gangrenous putrescent matter in general and of cadaveric material in particular. For the greater part, the cases have been explained in other ways, as we shall hear later.

"Among the papers and essays on this subject, none has made more of a sensation in England than an article by Robert Storrs, which is also printed in the yearly report of the Official Register, repeatedly used by me as a reference—Storrs questioned several colleagues of his vicinity by letter as to their experiences and opinions, and the result of this inquiry was about as follows: Reedal in Sheffield treated a young man who had an open inguinal abscess and a virulent erysipelatous inflammation of the scrotum and the buttock, and who finally (p 184) died—The sister of the young man, who nursed him, likewise acquired erysipelas of the face and head, accompanied by a fever with a typhoid character, from which she died in two days—While Reedal was treating his patient, five women, whom he attended during their confinements

from October 26 to November 3, 1843, became ill with puerperal fever and died. To these unfortunate women, he went almost immediately after dressing the young man's wounds. He also attended two other women during their confinements, but reached them some hours after that dangerous sick call, and no significant illness resulted. After the deaths of those women, Reedal made no more visits to the young man, because he considered himself as a disseminator of the disease. Since that time he has had no more puerperal fever in his practice than before he treated the case of erysipelas.

"Mr Sleight of Hull reported that he had treated a patient with almost gangrenous erysipelas, and while attending this case, was called to a confinement, which went off very easily and normally Nevertheless, 20 hours later the woman came down with

puerperal fever and died within 18 hours

"Hardey, likewise of Hull, treated a large abscess of the lumbar region, and at about the same time, an erysipelatous abscess of the breast. At the same time, many sheep, pigeons and cows died after delivery. In a month's time, Hardey took care of 20 confinements, and seven women died, all these labors had had a normal course and there was no other cause to be found for this unhappy outcome, moreover, no one in the immediate vicinity of the unfortunate women was attacked (p. 185) by a similar illness. Frequent chlorine washings and wholly new apparel finally put an end to the further spread of the disease. Some of the women whose puerperium ended happily were delivered only a few hours after those who lost their lives

"Three physicians of Hull attended together an autopsy on a man who died from gangrene after an operation for a hernia incarcerata. All handled parts of the cadaver. One of them was called away from the autopsy to a confinement. This patient and still other women delivered by him died one after another from puerperal fever. Not much better was the luck of his two colleagues, who in a short space of time after the autopsy had cases of puerperal fever in their practice. Chance brought them together again after some time. They lamented their unfortunate cases in common, gave up their obstetrical

practice for a time, and after their taking it up again had no more cases of the disease

"S Allen of York lost a series of patients by childbed fever... yet only in the first of these cases was he able to find any connection with erysipelas. For two months afterwards there appeared no more puerperal fever in his practice, then suddenly one of the women delivered by his assistant fell sick from this disease, the assistant at the time of the delivery wore a jacket, which he had last worn on the occasion of a night-vigil with one of the women far advanced in childbed fever. The husband of this patient was also stricken with peritonitis, had all the symptoms of puerperal fever, and died. This, as far as Allen knew, was the only case of transfer of the disease in the vicinity of the patient which appeared in his practice.

"Such are the answers of those colleagues with whom Storrs had corresponded

"Storrs now relates his experiences which, in his opinion, prove in every respect that the disease is contagious, and which predominantly indicate that its origin is to be sought in an animal poison. All of this, he thinks, shows the futility of medical treatment, and, for this reason, the most extreme necessity for preventive measures

"I On January 8, 1841, he attended Mrs D in confinement On the same day, he visited Mrs Richardson, who suffered from a gangrenous erysipelas, both patients were attended by the same nurse Mrs D died from puerperal fever, and her sister came down with typhus, after nursing Mrs D

"2 On January 13, Storrs was present at the labor of Mrs B, who also died A few days after, her mother-in-law fell ill with typhus, and died also The nurse, who cared for both of them, as also her son, likewise became ill of typhus, but recovered

"3 Again on January 13, Storrs was present during the confinement of Mrs Par, who also died Her husband was ill at the same time with erysipelas with a typhus-like fever, from which, however, he recovered A friend and neighbor of the deceased had erysipelas, pleuritis and an abscess, yet she recovered, her nurse was not so fortunate, for she died of typhus

"A fourth and a fifth patient recovered and were not the cause of the disease in anyone else

"6. On February 12, Storrs opened an abscess on the abovementioned Mrs Richardson, and afterwards attended Mrs Pol three (Eng) miles away (p 187) She died too Her sister had herpes, erysipelas with typhus-like symptoms, followed by an enormous abscess in the breast

"7 Mrs P was not delivered by Storrs, but only visited by him, Mrs P had laid out for burial Mrs B's infant, which had died some days previously from gangrene of the navel Storrs attended Mrs B in the interval between the three cases of illness first described Mrs P died and was soon followed by her baby, which died of gangrene of the navel and the genital organs

"8 Mrs W was delivered by Storrs, and died after he had opened the abscess for Mrs. Richardson on the previous morning. Storrs then took a 14-day trip and hoped to rid himself of the

contamination in this manner

"9 On the night of March 21, he confined Mrs. W after he once again had opened an abscess for Mrs Richardson in the morning, Mrs W. died

"10 A similar fate overtook Mrs Dk, who was delivered on the 22d.

"Some months later, as the poison was somewhat exhausted, Storrs' assistant dressed Mrs Richardson's leg, and the same day delivered a young woman, who was stricken later with a severe peritonitis, was bled twice—she recovered. In her case, the disease had a more sthenic character.

"By his essay, from which we have taken numerous extracts, and because he opposes the skeptics in regard to the English opinions on the dissemination of puerperal fever, Storrs hopes to have proven

(p. 188) I. That puerperal fever is communicable by contact

That it comes from an animal poison, and particularly from erysipelas* and its sequelae and also sometimes from typhus.

* Nunneley gives more detail as can be seen by the following remarks (A treatise on the nature, causes and treatment of erysipelas London, 1849)

P 87 "I shall bring in a definite listing the most pertinent reasons and facts which one can give for the proof of the identity of puerperal fever and erysipelas"

P 89 "Of the following I am at least convinced, that many questions which in

3. That childbed fever, without distinction as to the environment of the patient, causes erysipelas, typhus, and in the male sex, a fever which sometimes resembles puerperal fever to an extraordinary degree

4 That, in general, the quickest, most careful and most

judicious treatment is without result

"Particularly mindful of this last sad experience, Storrs' report is intended to prevent a similar mishap, to which purpose he proposes that accoucheurs shall never attend parturients in the same clothes which they wore on their visits to their other patients, this precaution should be applied chiefly to the outer garments, which, in Storrs' opinion, necessarily participate most in the transfer of the disease-producing material. As soon as erysipelas or typhus is prevalent, then this precaution should be observed during the puerperium

"After any sort of an autopsy, or after (p 189) an operation on an individual sick with erysipelas or typhus, the surgeon should wash his hands as carefully as possible and change his attire completely, before he attends any labor whatsoever, in this connection, one should not forget the gloves, because the hands and arms are above all the poison-carrying parts of the

body

"As soon as the disease has unfortunately established itself in the physician's practice, then he should entirely absent himself from his place of residence for the next two or three weeks, completely change his clothing, bathe himself very carefully and avoid every case of disease, which may be the source of animal poison

"A similar communication, made by Roberton, caused an unusual sensation in England A midwife, who had a very extensive practice among the parturients and puerperae cared for by a charitable organization, had the misfortune to see a

medicine, because of general agreement can be considered as facts, are in no way on such sure grounds, as those which we have just given as proof of the identity of puerperal fever and erysipelas"

It must also be mentioned that in the death list for London for 1842, 251 persons are reported to have died of erysipelas

woman delivered by her die from puerperal fever. During the month immediately following (December 1830), she attended 30 labors in widely separated parts of the city, and 16 of these puerperae fell ill with puerperal fever and died. This situation was even the more striking, because about 380 deliveries were attended by midwives through the aid of the same society, and all of the patients, with the exception of those previously mentioned, passed through their lying-in without any trouble. The physicians of the institution strongly urged that the midwife should give up her practice for some time and go into the country. A short time after, puerperal fever appeared at many places in the city and in the practice of other midwives and physicians. Up to June, it raged to an extent and with a violence which scarcely ever occurred in Manchester.

"Roberton did not attempt to explain the manner of conveyance of the disease in the case (p 190) of the midwife, but did, in this connection, mention two cases which, in his opinion, prove that the disease is carried directly from one patient to another. A physician introduced a catheter into a poor woman suffering from puerperal fever, and was called that same night to attend another woman during her confinement. On the morning of the second day, the woman had chills and other signs of incipient illness. Another physician, during an autopsy on a woman dead of puerperal fever, was called to a confinement case. 48 hours later, this patient became ill of the same disease

"Churchill* states, that in the beginning Campbell of Edinburgh did not believe in the contagiousness of the disease, but later changed his views and in a letter to L Lee relates the case

"In October, 1821, he autopsied a woman dead of puerperal fever after an abortion, he placed the genital organs of this cadaver in a bag and took them along to present during a lecture The same evening, and in the same clothes, he was present during the labor of a patient, who died soon after

the labor of a patient, who died soon after

"The next morning, Churchill undertook a forceps operation, without having changed his clothing Many puerperae attended by him in the next week became ill and three of them died

^{*} On the diseases of women by Fleetwood Churchill, 3 edit, Dublin, 1850

In June, 1823, he helped several of his students during an autopsy on a woman dead of puerperal fever. In the poor dwelling, bare of nearly everything, he could not wash his hands with the necessary care and he went home. On arrival there, he was told that two women needed his help during their labors, without any further attempt at washing and without changing his clothes, he hurried off to attend these patients, and both of them (p. 191) were seized with the disease and died. Similar cases occurred later in a very significant number

"It is very clear from the quotations, and particularly from the experiences of Dr Campbell, that the English do not take these transfers of disease in the sense in which Semmelweis and Skoda wish them to be understood, i e not through a transfer of putrid matter from the genital organs of the woman, but through the transfer of the disease qua talis from one woman to the other.

"That this is the interpretation is shown by the reports given above, but it is especially clear from the following expression of Churchill's. 'After an assiduous examination of the facts I cannot doubt that the disease is spread by contagion and contact, ie that it is communicated from a person suffering from childbed fever to another, who is in contact with this patient, or is in close proximity.'

"The answer to the question, which of the two interpretations is the correct one, is manifestly of great practical significance, but if the customary English view of the matter gains acceptance, then by no means does the prohibition follow therefrom, against having any contact with cadavers, dead from other diseases than puerperal fever, while, on the other hand, we do not hesitate to go from one sick puerperae to another, without having changed clothing as one is advised to do in England, because the doctrine of the communicability of the disease is so developed that one assumes that a healthy person (including the physician), who, visiting a patient ill during the puerperium, cannot carry the same disease to puerperae who have been well up to that time, without contact having taken place This capacity for transfer seems, according to the customary assumption, to have been thought possible for a long time, (p 192) because, according to

the frequent regulations laid down by the English writers, a physician, who has been so unfortunate as to have several patients fall ill with puerperal fever in his practice, should cease to render aid during deliveries for a long period, and a complete change of clothing is enjoined upon him. As proof, it was particularly alleged that so frequently a single accoucheur or midwife counted many cases of puerperal fever among his or her charges, while the other physicians did not have to report any cases It must be admitted that this situation may be very easily explained, if it is assumed (which may be shown in most of the cases reported above), that these practitioners have been doing either autopsies or their equivalent, i e opening abscesses, cleaning and dressing wounds, douching or examining puerperae, examining placentas and the like * Many of the abovenamed physicians, on account of the views customary in England have given up their midwifery practices, after they have had the misfortune to lose several patients from puerperal fever The fact that they were not more fortunate immediately upon resuming practice again after a period of several weeks seems to prove beyond all doubt, (p 193) that the cause blamed by them was no longer active, and upsets the conviction that things were the same as before"

It is also my conviction that the activities of the physicians as described above were the causative factor for the peurperal fever occurring after these activities, for this reason, I have presented these data here to show the reader that one may come in contact with affairs outside the lying-in hospital, and as a result, puerperal fever occurs outside the hospital

But from these data, I draw other conclusions than the English

physicians do

I do not regard childbed fever as a contagious disease, because it cannot be carried from every patient, ill with childbed fever, to

^{*} Dr A Martin, the Director of the Midwives' School in Munich, has had the courtesy to inform me orally that puerperal fever in the first years of its seriousness had many victims without its being possible to discover the cause in the small, well-situated institution. Only after a while did he become aware of the fact that the midwives used to throw the placenta into the privies. After having discovered this situation, the health of the community was considerably improved.

healthy ones, and because a healthy patient can contract childbed fever from a diseased patient who is not even ill from childbed fever

Every case of small-pox is capable of giving small-pox to a healthy person, and a healthy person can only get small-pox from a case of small-pox, but from a case of uterine carcinoma no one has yet gotten small-pox

Such is not the case with childbed fever, if it runs its course under a form which does not produce decomposed matter, then it is not communicable to a healthy person. However, childbed fever produces a decomposed matter, e.g. in endometritis septica, then it is certainly communicable to well persons. After death, every cadaver is a source of childbed fever for healthy patients, provided putrefaction has reached a certain stage. Moreover, childbed fever may come from diseased conditions which are certainly not childbed fever, such as gangrenous erysipelas, carcinoma uteri, etc

(p 194) Every cadaver, dead from whatever cause, is capable of causing childbed fever if the cadaver has attained the necessary degree of putrefaction.

A contagious disease is propagated by a material which can only cause the disease in question. Caries has never yet caused small-pox. Puerperal fever is propagated by a material which is the product, not of childbed fever alone, but likewise of the most heterogeneous diseases.

Every cadaver, dead from whatever cause, produces the material which causes childbed fever

From this follows the prohibition of contact with cadavers, or with diseased patients, whose illness produces a decomposed matter, whether they are in the puerperal state or not

For me it is an incontestable fact, that the veterinary surgeon, who at the same time may be an accoucheur, will cause childbed fever through the decomposed matter acquired from diseased or dead animals

Childbed fever, therefore, is not a contagious disease, but is a disease which it is possible to carry to a healthy person by means of a decomposed matter. There is no more relation between

childbed fever and erysipelas and its sequelae, than there is with any other disease which engenders a decomposed matter, childbed fever stands in relation to erysipelas and its sequelae as to any putrefying cadaver. If the English physicians recognize, outside of puerperal fever itself, only erysipelas and its sequelae as sources of the decomposed matter which causes childbed fever, then they draw the limits too close, as the above facts already show: erysipelas was not the only source, (p. 195) from which the material was taken for the above-mentioned cases of childbed fever

Childbed fever, therefore, is the same disease which occurs in the case of surgeons, anatomists, or follows surgical operations, the same disease which results from the introduction of a decomposed material into the circulatory system of males or females

This decomposed matter is not absorbable through the epidermis, or through a thick epithelial layer, and in case of surgeons or anatomists, absorption must be preceded by a wound

Kolletschka, an excellent pathological anatomist, had on innumerable occasions soiled his hands with decomposed matter, and remained healthy, but absorption was made possible through a prick, we know what disease was the result

The place of absorption can be any point on the body which is denuded of epidermis, or of epithelium

In gravidae, parturients or puerperae, there is a place in the body, which has no epidermis or epithelium, and that is the internal surface of the uterus, starting from the internal os upwards, this is the absorption place for the decomposed matter which causes puerperal fever. If wounds are caused by labor, then every place on the genitals, indeed any wound on the body, can be a site of absorption.

We have previously related how the external genitals of two puerperae became gangrenous at Pest in the obstetrical clinic during the school year 1857–8, a pupil-midwife, who had these puerperae in her care, had a small abrasion on her finger, the result of a wound from a needle, she became ill of lymphangitis with suppuration of the axillary glands, and had a serious illness of several months duration

(p. 196) Since puerperal patients, as a rule, offer no suitable

place for absorption outside of the genitalia, then necessarily the decomposed matter must be introduced by way of the genitals. Since the apparel of the accoucheurs is not introduced into the genitals, the English custom of changing the clothing completely, in order not to spread childbed fever through it, is indeed a harmless but superfluous precaution. I and the students in Vienna in 1848 did not change our clothing after contact with anything which had the property of causing childbed fever, we only exposed our hands to the action of chlorine, and during 1848, lost only 45 out of 3556 puerperae, i.e. 1.25%, from childbed fever

In the above-mentioned cases, where the accoucheur, without having changed his clothes, visited healthy parturients who then died of childbed fever, it was certainly not the clothing but the hands which were the carriers of the decomposed matter, and the hands, because they could not be changed, should have been disinfected. If the clothing had become soiled with decomposed matter in the manner stated, then the hands were contaminated so much the more, and the internal examinations were made with such hands

In order that childbed fever may occur, it is a conditio sine qua non, that the decomposed matter be introduced into the genitalia, and indeed individuals within and without the lying-in hospitals can undergo all possible medical examinations by hands contaminated with decomposed matter, with the exception of the exploratio obstetricia interna, without being exposed to the slightest danger thereby.

That the epidermis prevents absorption of the decomposed matter (p. 197) is proven by the fact that the accoucheur, in good health, carries around for hours and days on his hands the decomposed matter which, through the internal examination, is brought into contact with the internal surfaces of the uterus for an instant, is absorbed and thus causes childbed fever

The hands of the anatomist for hours at a time are frequently brought in contact with rotting cadavers and still remain healthy, but if the epidermis is removed by injury, then will follow the disease which we observed in Kolletschka and the pupil-midwife.

Because of the location of the wards of the First Obstetrical

Clinic, the general rounds were made twice daily in the following order, first, a visit was made to the labor room, then half of the healthy puerperae were seen, next to the sick-ward, and finally the rounds were finished with the visit to the second half of the healthy puerperae

If we contaminated our hands in the sick wards among the sick puerperae, and then examined, without previously having washed our hands in chlorine, healthy puerperae of the second half as to the pulse, palpated the abdomen externally, in a word, made all the necessary examinations with the exception of the exploratio obstetricia interna, we have not thereby multiplied cases of childbed-fever, because in 1848 we lost only 45 out of 3566 puerperae, or 1 25%

Thus childbed fever cannot be acquired through the uninjured external surface of the body, it is not so spread by a sort of a pustule, so that the outer surface of a healthy individual must come into the atmosphere of a sick person

But if the exhalations of a sick person penetrate into the uterine cavity along with the atmosphere, then indeed childbed fever does occur.

(p 198) We have previously asserted, that the practice of the English in changing the clothes after a visit to a sick puerpera before attending a healthy one is indeed a harmless but superfluous precaution, since the clothing, which is contaminated with decomposed matter, does not come in contact with the place where the absorption normally occurs, ie the uterine cavity, the clothing can only cause childbed fever if its exhalations penetrate into the uterine cavity with the atmospheric air, if the clothing cannot easily be cleaned, care must be taken against contaminating it. In Vienna, we have never changed our clothes and I do not do it now The clothing can participate in the causation of childbed fever if, for instance, during the examination of a puerpera, the sleeve of a coat, contaminated with decomposed matter, comes in contact with the genitals injured during labor, an event which certainly does not occur daily

In this sense, the clothing can indeed be a source of danger, but certainly not in the sense of the English who believe that the

puerperal contagium, like the small-pox contagium, can be carried

on the clothing to a healthy puerpera, who then absorbs it like the small-pox contagium through the outer surface of the body.

Under normal conditions, only the internal surface of the uterus is the portal of entry for puerperal fever, but, having a lesion any place on the body can serve as portal of entry

If the English physicians have the misfortune to lose several puerperae from childbed fever, they are not satisfied even to wash themselves with chlorine water, but give up their obstetrical practice for several weeks, (p 199) or take a trip of several weeks duration, in order to free themselves entirely of the puerperal contagium. We destroy the decomposed matter by chlorine-washings and consider this disinfection as sufficient

In Vienna during the month of April, 1847, we lost 57 puerperae out of 312, 18 27%, from childbed-fever and in the following May, 36 out of 294 puerperae, or 12 24%, in the middle of May, we introduced the chlorine washings with the results of which the reader is familiar, without having to interrupt the attendance in the lying-in hospital of myself or the students

Herewith, I believe I have stated sufficiently clearly the difference between my theory of puerperal fever and the theory of the English physicians, and on the spread of the disease.

In order to avoid repetition, I have chosen this place in my essay for the discussion of these matters, although we had taken up other subjects

If, formerly, the question was how an epidemic disease could also be caused by trauma, there is now no problem, since we know that puerperal fever is engendered through the absorption of a decomposed matter

As a result of crushing during a difficult forceps operation, places on the genitalia become necrotic, these necrotic areas, if absorbed, cause childbed fever by autoinfection

That the large mortality among the puerperae is not dependent upon atmospheric influences, but is caused by the introduction of a decomposed matter from without, is proven by the geographic (p 200) distribution of childbed fever Litzmann* says, on p 129, of the geographic distribution of childbed fever:

^{*}Das Kindbettfieber in necrologischer, geschichlicer und therapeutischer Beziehung von Dr C F Carl Litzmann Halle, 1844.

"Most of the epidemics known to us are limited to Middle Europe The reports on extra-European epidemics are scanty, they include observations on childbed fever in Philadelphia by Hodge, and in Jerusalem by Scholz In general, the colder and damper countries seem to be visited more commonly, e.g. England, which seems to have been more exposed by this plague than France, and also the cities which lie on the banks of our large rivers, such as Vienna For that reason, according to Brydone's report, in Sicily, for example, women seldom become ill after delivery, Savary, in his letter, says of the Egyptians, that the milk-disease is wholly unknown there, and Dr Salles asserts that during his three-year sojourn in South America he had seen no puerperal fever there. Still these statements are insufficient as a basis for any conclusions Probably childbed fever is disseminated all over the world, and its more or less frequent occurrence is less dependent on the climate than on the presence or lack of large cities, and especially of the larger obstetrical hospitals"

(p 201) Convinced that childbed-fever is caused by the absorption of a decomposed matter, I interpret these statements of Litzmann on the geographic extension of childbed fever in the following manner. certainly childbed fever is spread over the world as the result of auto-infection in rare cases. Childbed fever is certainly spread in single cases over the whole world as the result of infection from without, also in rare cases. Childbed fever certainly is spread over the whole world as the result of infection from without, because there are found all over the world diseases which engender a decomposed matter, and also there are medical personnel of both sexes, who deal with such diseases and with gravidae, parturients and puerperae

Certainly childbed fever may or can be scattered in great numbers over the entire earth, if a decomposed matter scattered over the whole world can be introduced into individuals from without But that occurs only in Middle Europe Here there is reason for handling decomposed matter, there is opportunity in the lying-in hospitals to bring the decomposed matter in contact with many persons at the same time Childbed fever is noticeably confined to the large cities, because the large lying-in hospitals are there, that it is not the cities themselves which cause childbed fever, is proved by the fact that childbed fever can be suppressed in the large lying-in hospitals, because after closure of the hospitals, the gravidae may be delivered out in the city.

That the puerperal epidemics in Vienna did not occur because Vienna lies on the banks of a large river, is evident from the fact that since the fearful puerperal epidemic, 25 years have passed, during which time less than one out of 100 puerperae died in the lying-in hospital, although, during these 25 years, Vienna lay on the same large river, through the introduction of the chlorine washings the Danube has not dried up, but the epidemics have ceased. If the Danube had caused the epidemics, wherein lies the reason that the Danube does this only in Vienna and not in all the places, which lie on its banks from its source to its mouth?

If childbed fever does not occur in Sicily, Egypt or South America, it certainly does not occur because there is a lack of water in those countries, but because anatomy in its branches and the anatomic trend in medicine have not yet observed the triumph there, which is the pride of the Vienna school and the misfortune of the Vienna Lying-in Hospital

(p 202) The published reports of the English lying-in hospitals show an average mortality of 1%, the French of 4%, it is therefore incorrect when Litzmann says that England has been more subjected to the plague of childbed fever than France

That childbed fever is caused, not by atmospheric influences, but by the absorption of a decomposed matter, the history of childbed fever proves Litzmann says, in his history of childbed fever in which all epidemics up to the year 1841 are enumerated. "As far as the foregoing historical documents permit an opinion, childbed fever is above all a disease of modern times. The case-histories reported by Hippocrates, which are usually classed as of childbed fever, do not belong in that classification. They are only examples of the then prevailing bilious fever, which did not behave differently among puerperae than among non-puerperal men and women, and were nowhere designated by Hippocrates

himself as distinct and specific diseases Pains in the right hypochondrium, severe diarrhea and severe vomiting, headache with delirium or coma, fever with more or less frequent irregular attacks of chills compose in all cases the striking symptoms, in puerperae, the disturbance of the lochia hardly furnish a reason for the distinction, in only three, do we find a suppression of the lochia, and in two of these are pains in the region of the uterus mentioned The repeated chills, by which some of the patients were attacked, have been established recently by Helm as indicating metrophlebitis

(It is at least doubtful whether one may connect this single symptom with phlebitis, if the diagnosis may not be supported by other signs, and particularly if confirmation is lacking (p 203) from the autopsy. Here it refers even less to metrophlebitis, because, aside from the wholly lacking, very unimportant phenomena of uterine disease, the condition was also observed in males (Epid lib. III, sect II, aeger. no 5, sect III, aeger no. 3) Should the chills therefore be considered as due to a venous inflammation, then, according to the symptoms at hand, we can look for the site of the disease nowhere else than in the vascular system of the liver. (Hippocrates, Epidem lib I, sect III, aegra no 4, 5, 11, lib. III, sect. II, aegra no. 10, 11, 12, sect. III, aegra, no 2, 14)

The first, although still indistinct signs of puerperal fever are met with in the second half of the 17th century in the Hotel-Dieu in Paris. Peu relates that in the hospital mentioned the mortality among the newly delivered was very great and in certain seasons and in certain times of the year more than in others Particularly devastating was the year 1664. Vesou, the hospital physician, ascribed the reason for this appalling mortality to the fact that the lying-in ward was directly over the ward for the wounded. The mortality among the puerperae stood in direct proportion to the number of the wounded. It was increased by damp weather, either warm or cold, in dry weather it changed. The disease disappeared on removal of the puerperae to the lower floor. The description of the disease is highly defective, it was only said that the sick patients up to the time of their

deaths suffered from hemorrhages, and that at the autopsy the bodies were found to be full of abscesses

Rather more accurate information on the Hotel-Dieu and the cause of the childbed fever prevailing there is given by Osiander in the work cited above On p 243 he says "In the noteworthy report which Tenon rendered in 1788 on the hospitals under the Paris administration,* (p 204) one reads on p 241 and beyond, that the abdominal inflammation, "la fievre puerperale," as the writer always calls the disease, had raged since 1774 among the puerperae of the Hotel-Dieu every winter, and on many occasions 7 out of 12 puerperae were ill from this fearful disease So as not to find this extraordinary, one should know in what pitiable circumstances the puerperae and gravidae were at that time in the Hotel-Dieu Shut up in low and narrow rooms of the upper stories, crowded with beds, it was not uncommon that three puerperae lay side by side on a bed four feet wide, because in 1786 there lay in 67 not over-wide beds 175 gravidae and newly delivered women Sixteen nurses were in attendance this, the puerperal wards were over other sick-wards of the hospital, and if the wounded did not indeed lie under the puerperal wards as formerly,† one may assume that certainly the proximity of the large sick wards contributed to the pollution of the air and to the production of dangerous miasmata in the puerperal wards, etc , etc "

Thus the first epidemic of childbed fever which may be recognized as such, was caused not by atmospheric influences, but as I teach it. And if no "Historiograph" be found which will reveal to us the secrets of the remaining innumerable puerperal-epidemics, then the history of childbed fever shows, with the exception of a few epidemics, (p 205) the autopsy-findings of the epidemics under consideration, and thereby, the sources from which the epidemics prolong their existence. I have shown the

^{*} Mémoire sur les hospitaux de Paris

[†] As far back as the year 1664, a physician by the name of Lamoiquou of the Hotel-Dieu, traced the frequency and danger of childbed fever in this hospital to the position of the lying-in wards above those in which the wounded were kept and Peu and Desault made the observation that after the wounded were removed from that room, the occurrence of the disease (childbed fever) was lessened

conditions from which the epidemics of the Vienna Lying-in Hospital, of the obstetrical department at St Rochus and of the obstetrical department at Pest, have arisen

The history of the epidemics of puerperal fever at the Vienna Lying-in Hospital presents the proof, that the frequency and the virulence of the epidemics stands in direct proportion to the development and improvement of the anatomic trend of Medicine.

Boer, the reformer of obstetrics and the author of *Natural obstetrics*, began his teaching in 1789, but discouraged by the mortality then considered enormous, prematurely relinquished his office in 1822 to Professor Klein. Yet Boer, during 21 years had lost less than one puerpera out of 100, during 6 years, the mortality was 1 out of 100, during four 2 out of 100, during one year 3 and one year 4 out of 100

In what a horrible manner, as a result of the anatomic trend of medicine, has the mortality increased since his time, even during the twelve years after the introduction of the chlorine washings. From 1822 to 1858 inclusive, the mortality for 1 year was 00%, during 3 years 1%, 6 years 2%, 4 years 3%, 6 years 4%, 4 years 5%, 3 years 6%, 4 years 7%, 5 years 8% and 1 year 12%.

The history of the puerperal epidemics shows that they are usually connected with lying-in hospitals, therefore, if childbed fever rages simultaneously in lying-in hospitals which are widely separated from one another, e.g. in Paris and Vienna, then this fact cannot be explained by saying that the atmospheric-cosmictelluric influences reach from Paris to Vienna, (p. 206) but by saying that patients in the Paris and Vienna lying-in hospitals are infected at the same time. If it actually were the atmospheric influences which reach from Paris to Vienna, then not only would the puerperae in the Paris and Vienna lying-in hospitals become ill, but the puerperae among the people living between Paris and Vienna must share the same fate, but we know this is a contradiction, because even the puerperae outside the lying-in hospitals enjoy good health in the cities in whose lying-in hospitals the puerperae fall victims in great numbers to childbed fever.

For our purpose it is a matter of indifference whether the cases related by Hippocrates were childbed fever or not Hippocrates

had only a few cases to deal with, and these few cases could have been due to auto-infection, or, if they were cases of infection from without, there were in Hippocrates' time, sick patients whose disease engendered a decomposed matter, and there were also medical personnel of both sexes, who treated such diseased patients along with pregnant, parturient and puerperal women, whereby infections could also occur from without. Moreover, Boer says of Hippocrates, v. 11, p 3 "One is filled with astonishment and respect when, in the handling of puerperal fever, autopsies are done, and a comparison is made of the course of the disease and the findings in the cadaver with what Hippocrates adduced so truly and pertinently, more than 2000 years ago.

"If, during each century, (p 207) only one such observant physician were born, instead of so many systems of teaching, how much more would have mankind, and the animal kingdom, gained thereby

"The Book of diseases of women, from paragraph 60 almost up to paragraph 90, contains an historical description of all these forms under which puerperal fever tends to occur in sporadic cases, and in the Book of prevailing diseases of the people are some observations on the disease, how it occurs endemically, so exactly and masterfully portrayed that it could not have been more accurately done, if it were written yesterday at the side of the sick bed and of the autopsy table, etc, etc"

My conviction derived from the results of the chlorine washings, that there never was a childbed fever dependent on atmospheric influences, and therefore the endless series of puerperalepidemics, as such are enumerated in the medical literature, were merely preventable cases of infection from without, was completely confirmed by reading the history of childbed fever

We shall now briefly recapitulate all the reasons which have forced upon us the conviction that there are not atmospheric-cosmic-telluric influences, capable of producing childbed fever, and that there never were such things We shall briefly recapitulate the reasons which have forced upon us the conviction that

^{*}Dr Lucas Johann Boer Abhandlungen und Versuche zur Begründung einer neuen, einfachen und naturgemassen Geburtshilfe Wien, 1810

the great mortality, which has been attributed to epidemic influences, was caused by the absorption of a decomposed matter into the circulation of the individual, and that, excepting cases of auto-infection, this decomposed matter was introduced into the individual from without. Therefore the endless series of so-called epidemics, as such are cited in the medical literature, were purely preventable cases of infection from without

The most important reason is, that in three institutions (p. 208) by the destruction of the implicated decomposed matter, I was successful in limiting the childbed fever to a much smaller number of cases than before, which obviously would not have occurred, had childbed fever been caused by atmospheric influences

If it is not quite in agreement with the concept of the atmospheric origin of childbed fever, that childbed fever should be prevalent in great numbers at any season of the year, and then again should not prevail at any season of the year, that it should occur in greater numbers in any climate, and again that it does not occur in any climate, then again, it is clear, as soon as one realizes that fact, that childbed fever originates through infection from without

If it is not to be explained through atmospheric influences, why the lying-in hospitals were spared over a long series of years, and later were plagued over a long series of years, and every year, by the so-called epidemic childbed fever, again the explanation is not difficult, as soon as one realizes, that at the time of the most favorable state of health, decomposed matter was seldom conveyed to the inmates of the lying-in hospitals from without, while later the conditions were changed to such an extent that the introduction of decomposed matter occurred unusually often. If it is not to be explained by atmospheric influences, how does it happen that a lying-in hospital was visited regularly year in and year out by the so-called epidemic childbed fever, then for a year remained free of it? Again it is evident, after one knows, that conditions in the lying-in hospitals can be altered to the extent that decomposed matter is seldom introduced into the individual, after it has been a frequent occurrence, these conditions can thereby be so altered that the hands of the examiner

(p 209) are rarely contaminated, or the examining hand is cleansed

If the different states of health in two divisions of one and the same institution cannot be explained through atmospheric influences, the difference in the states of health is very understandable, if one knows that decomposed matter is introduced into the individual from without in the one division rarely and frequently in the other

If these things cannot be explained by atmospheric influences, how then does it happen that the puerperae out in the city are well, while the puerperae in the lying-in hospital are carried away by epidemic childbed fever? And how then does it occur that those about to be delivered are saved by closing the lying-in hospital, and by being delivered out in the city, where the lying-in hospital offers a bad state of health in consequence of the atmospheric influences? It is all clearly explained when one knows that a decomposed matter is conveyed to the individual from without rarely because of conditions in the home, and more frequently in the lying-in hospital If it cannot be explained through atmospheric influences, how does it happen that several lying-in hospitals in one and the same city can have different health conditions at the same time? The matter is very clear, because it is now known that childbed fever is engendered by the introduction of a decomposed matter, in the different lying-in hospitals of one and the same city the decomposed matter is introduced from without into the individual more or less frequently

We have seen that in the First Obstetrical Clinic in Vienna the mortality during six different years was three times as great as in the Second Clinic, although the two divisions were separated only by a common anteroom. In Strassburg, the two divisions were separated only by a room which contained the beds of the pupil-midwives, (p 210) and the two likewise had a strikingly different mortality

In the Maternité, childbed fever was already raging at the end of the 18th century, in Vienna it first began in the year 1823, in Dublin over a period of 98 years the mortality reached three

percent only in three different years, in seven lying-in hospitals in England, Ireland and Scotland the mortality on the average was only one percent.

How can the theory of epidemic childbed fever, in which it is claimed that the atmospheric influences which cause childbed fever, extend themselves over whole countrysides, even over the whole continent, if childbed fever rages all over the continent as the result of atmospheric influences at one time, how can this theory be made to agree with the data presented on the frequency of childbed fever?

How were the atmospheric influences, which even at the end of the last century were raging among the puerperae at the Maternité in Paris, prevented from extending their power up to the year 1823, to Vienna, although in 1823 whatever obstacle there might have been to their progress was overcome, so that from that year on they exerted their powers even more fearfully in Vienna than in Paris. How did it happen that the atmospheric influences after having at last reached Vienna, were extended to England, Ireland and Scotland in a form so attenuated that it was not possible there to exert their whole force, as in Paris and Vienna?

What was there in the common anteroom of the two clinics in Vienna, that successfully protected the Second Division against the influences covering the whole country-side?

Wherein lies the reason that the room in Strassburg, which contained the beds of the pupil-midwives, was able to accomplish the same thing?

(p 211) How may one by closing the lying-in hospitals, protect individuals against influences which extend over the whole country-side?

As soon as it is realized that childbed-fever is caused by the introduction of decomposed matter from without, the explanation is easily made. In the Maternité in Paris even at the end of the last century, due to the teaching-system, decomposed matter was introduced into the individual, in Vienna it began in 1823, from then on simultaneously in Vienna and Paris this same process went on, in England, Ireland and Scotland, for reasons which we have previously explained in detail, the transfer of decomposed matter never occurred to the same extent, and

hence the better state of health The protective force of the anteroom in Vienna for one division, and of the room in Strassburg containing the beds of the pupil-midwives, is explained by the fact that decomposed matter was introduced from without into patients on the one side of these rooms and but seldom on the other. Patients were protected by closing the lying-in hospitals, because decomposed matter was less frequently conveyed to them if they were delivered outside the hospital

It was not atmospheric influences which spread over the whole country-side and caused childbed fever, but decomposed matter throughout the land was introduced into patients from without, and for that reason childbed fever spread all over the country

To the honor of the accoucheurs I am willing to believe that never yet has one attempted to make these well-known facts agree with the theory of epidemic childbed fever, because I cannot believe that any person, to whom truth is a serious thing, could have faith in the theory of epidemic childbed fever for any longer than the instant (p. 212) in which the disagreement of the theory with the facts would become apparent. Anyone who in spite of these facts still pretends to believe in epidemic childbed fever, does not have the courage to admit the truth, because he feels that with the acknowledgement of the truth the confession of a great guilt would have to be made. Now that the facts of the case cannot be altered, the guilt is still greater through denial of the facts. Anyone who, in spite of these facts, really believes in epidemic childbed fever, has no convictions, has no comprehension and only carries around in his memory words learned by rote

The theory of epidemic childbed fever explains the unknown only with something unknown Many die, no one knows why, the explanation is again and again the unknown atmospheric influences, yet no special atmospheric influence can be alleged because childbed fever has no relation to the season of the year or the climate

These are my reasons I wish, in the interest of mankind, that all those concerned may draw from them the conviction which I have drawn

The arguments which have been advanced by my opponents

in the support of atmospheric influences, and which have not yet been refuted, will be evaluted in the critical estimation of these opponents in order to avoid repetition.

* * * *

(p. 213) ENDEMIC CAUSES OF CHILDBED FEVER

Overcrowding of the lying-in hospitals is only conditionally an endemic factor in the causation of childbed fever, because in an overcrowded lying-in hospital it is more difficult to maintain the necessary degree of cleanliness, because in an overcrowded lying-in hospital it is more difficult to completely isolate those individuals who are a source of danger to others, thus, the overcrowding can cause the production of decomposed matter, and the transmission of this material to other patients. If, in spite of the overcrowding, the necessary cleanliness is observed so that no decomposed matter can be produced, the dangerous individuals can be sufficiently isolated from the rest, or no dangerous patients are present, then the transmission of decomposed matter to healthy individuals is prevented, under such conditions it is a matter of indifference, whether the lying-in hospital is overcrowded or not

By means of ten tables (4–13), we have proven repeatedly that the favorable or unfavorable state of health among the puerperae in the First Clinic in Vienna did not stand in direct proportion to the overcrowding, if we now add to the period covered by the ten tables, (p. 214) the twenty-one months during which the chlorine washings were used under my direction, then it is demonstrated even more conclusively that the favorable or unfavorable state of health among the puerperae did not depend upon the degree of overcrowding, because the state of health among the puerperae was favorable or unfavorable, whether the hospital was overcrowded or not

In the overcrowded lying-in hospital examinations can be made with clean hands, and the state of health remains favorable in spite of the overcrowding. When examinations are made with unclean hands, what should be attributed to the unclean hands is blamed on the overcrowding. In an uncrowded lying-in hos-

pital examinations can be made with clean hands, and the favorable state of health is attributed to the uncrowded condition, a merit to which this condition is not entitled, if examinations are made with unclean hands in an uncrowded hospital, the state of health will be a bad one.

In Table XXXVI, we shall use the months from January 1, 1841 to March 1, 1849 exclusive, in all 97 months, because December 1841 is lacking.

In 1848 in the month of March, none of the 276 puerperae, and in August, none of the 261 puerperae died.

The five most unfavorable months out of these 97 were those in which less puerperae were cared for, than in the two most favorable of these 97 months.

(p 215)

TABLE XXXVI

	Percent	Deaths	Births	Births Less
March 1848 August 1848 December 1842 October 1842 August 1842 November 1842 November 1841	31 38 29 33 25 46 22 96 22 55	75 71 55 48 53	276 261 239 242 216 209 235	37 34 60 67

During these 97 months, in one month the number of puerperae was the same and in 62 months a lesser number. The mortality remained the same during a lessened overcrowding as Table No XXXVII shows

(p 217) But if we consider, not only the degree of overcrowding, but at the same time the season of the year, then we find that even in the same season of the year, either with an equivalent or a lesser overcrowding, a strikingly greater mortality occurs as Table No XXXVIII shows

The greatest overcrowding during these 97 months was in January, 1849, with 403 puerperae, of whom 9 died, or 2.23% In 67 months out of the 97, the absolute mortality was greater,

In 67 months out of the 97, the absolute mortality was greater, although there was a lesser number of puerperae, hence a lesser degree of overcrowding than with the greatest number of puer-

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TABLE XXXVII

Month	Year	Puerperae	Deaths	Percent	Births Less
March	1848	276	00	0 00	
Aug	1848	261	00	0 00	
March	1844	276	47	17 03	Equal
Feb	1845	274	13	5 11	2
June	1842	273	18	6 60	3
Dec	1847	273	8	2 93	3
Jan	1843	272	52	19 11	4
Sept	1846	271	39	14 39	5
Aug	1844	269	17	6 32	7
July	1848	269	ı	0 37	7
June	1847	26 8	6	2 38	8
Dec	1845	267	28	10 48	9
March	1843	266	33	12 40	10
June	1846	266	27	10 15	10
Nov	1845	265	29	10 14	11
March	1842	264	27	10 23	12
Aug	1847	264	5	r 89	12
June	1848	264	3	1 13	12
Feb	1843	263	42	15 96	13
Sept	1847	262	12	5 23	14
Aprıl	1845	260	11	4 23	16
Feb	1844	² 57	29	11 28	19
Dec	1844	256	27	10 55	20
Aprıl	1841	² 55	4	I 57	21
May	1841	255	2	0 78	12
Jan	1841	254	37	14 46	22
Oct	1846	254	38	14 98	22
Aprıl	1846	² 53	48	18 97	23
Nov	1843	252	18	7 14	24
July	1846	252	33	13 11	24
Aug	1845	251	9	3 58	25
Oct	1843	250	44	17 60	26
July	1847	250	3 8	1 20	28
Oct	1844	248	3	3 22 6 10	į .
May	1843	246	15	t .	30
Nov	1847	246	11	4 47 1 22	31
Sept	1844 1845	245	3	6 12	31
July	1845	245 245	27	11 00	31
Nov.	1844	244	37	15 16	32
Jan April	1842	242	26	10 74	34
Aprıl Oct	1842	242	71	29 33	34
May	1844	240	14	5 83	36
Feb	1841	239	18	7 53	37

TABLE XXXVII—Concluded

Month	Year	Puerperae	Deaths	Percent	Births Less
Dec	1842	239	75	31 38	37
Sept	1845	² 37	25	10 55	39
Oct	1841	236	26	11 00	40
Dec	1843	236	19	8 15	40
Nov	1841	235	53	22 55	41
July	1842	231	48	20 79	45
June	1844	224	6	2 67	52
Sept	1842	223	41	18 38	53
Aug	1841	222	3	1 35	54
Sept	1843	221	5	2 26	55
Aug	1846	216	39	18 05	60
Aug	1842	216	55	25 46	60
Sept	1841	213	4	1 87	63
Nov	1842	209	48	22 96	67
Aprıl	1844	208	36	17 80	68
July	1844	206	9	4 37	70
June	1841	200	10	5 00	, 76
June	1843	196	8	4 08	80
Aug	1843	193	3	i 55	83
July	1843	191	ī	0 52	85
July	1841	190	16	8 42	86

TABLE XXXVIII

Year	Mothers	Deaths	%	Births Less
		March		
1848	276	00		
1844	276	47	17 03	Same
1843	266	33	12 40	10
1842	264	27	10 23	12
		August		
1848	261	00		
1845	251	9	3 58	10
1841	222	3	I 35	39
1842	216	55	25 46	45
1846	216	39	18 05	45
1843	193	3	1 55	68

perae, 1 e. the greatest overcrowding in January, 1849, as Table No XXXIX shows.

TABLE XXXIX

Month	Year	Mothers	Deaths	%	Births Less	Deaths More
Jan	1849	403	9	2 23		
Feb	1849	389	12	3 08	14	3
Jan	1846	336	45	13 39	67	36
Aprıl	1847	312	57	18 27	91	48
March	1846	311	48	15 43	92	39
Jan	1847	311	10	3 21	92	I
Feb	1842	311	38	12 21	92	29
May	1842	310	10	3 23	93	1
Jan	1842	307	64	20 84	96	55
May	1846	305	41	13 44	98	32
Mar.	1847	305	11	3 60	98	2
Jan	1845	303	23	7 59	100	14
Dec	1846	298	16	5 37	105	7
Nov	1846	297	32	10 77	106	23
May	1845	296	13	4 39	107	4
May	1847	294	36	12 24	109	27
Feb	1846	293	53	18 08	110	44
Mar	1845	292	13	4 45	111	4
Apr	1843	285	34	11 93	118	25
Oct	1845	283	42	14 84	120	33
Jan	1848	283	10	3 53	120	I
June	1845	280	20	7 14	123	11
Oct	1847	278	11	3 95	125	2
Mar	1841	277	12	4 33	126	3
Mar	1844	276	47	17 03	127	38
Feb	1845	274	13	5 11	129	4
June	1842	273	18	6 60	130	9
Jan	1843	272	52	19 11	131	43
Sept	1846	271	39	14 39	132	30
Aug	1844	269	17	6 32	134	8
Dec	1845	267	28	10 48	136	19
Mar	1843	266	33	12 40	137	24
June	1846	266	27	10 15	137	18
Nov	1845	265	29	10 94	138	20
Mar	1842	264	27	10 23	139	18
Feb	1843	263	42	15 96	140	33
Sept	1847	262	12	5 23	141	3
Apr.	1845	260	11	4 23	143	2
Feb	1844	257	29	11 28	146	20
Dec	1844	256	27	10 55	147	18
Jan	1841	254	37	14 46	149	28
Oct	1846	254	38	14 98	149	29
Apr	1846	253	48	18 97	150	39
Nov	1843	252	18	7 14	151	9

TABLE XXXIX—Concluded

Month	Year	Mothers	Deaths	%	Births Less	Deaths More
July	1846	252	33	13 10	151	24
Oct	1843	250	44	17 60	153	35
May	1843	246	15	6 10	157	6
Nov	1847	246	11	4 47	157	2
July	1845	245	15	6 12	158	6
Nov	1844	245	27	11 00	158	18
Jan	1844	244	37	15 16	159	28
Apr	1842	242	26	10 74	161	17
Oct	1842	242	71	29 32	161	62
May	1844	240	14	5 83	163	5
Feb	1841	239	18	7 53	164	9
Dec	1842	239	75	31 38	164	66
Sept	1845	237	25	10 55	166	16
Oct	1841	236	26	11 00	167	17
Dec	1843	236	19	8 05	167	10
Nov	1841	235	53	22 55	168	44
July	1842	231	48	20 79	172	39
Sept	1842	223	41	18 38	180	32
Aug	1846	216	39	18 05	187	30
Aug	1842	216	55	25 46	187	46
Nov	1842	209	48	22 06	194	39
Apr	1844	208	36	17 30	195	27
June	1841	200	10	5 00	203	1
July	1841	190	16	8 42	213	7

If, by the use of the previous tables, we consider the relative mortality in 77 of the 97 months in the presence of a lesser number of puerperae, i.e. a lesser degree of overcrowding, we find that it was greater than with the greatest number of puerperae, i.e. with the greatest amount of overcrowding in January, 1849, as Table No XL shows

While, before the introduction of the chlorine washings, the relative mortality in 24 out of 76 months was greater with a lesser degree of overcrowding present than during the greatest amount of overcrowding in January, 1849, (Tables No IV and V, p 107 and 108) and during 51 months with a lesser degree of overcrowding a lessened mortality prevailed, after the introduction of the chlorine washings, the overcrowding became a still more insignificant factor, because in 77 of the 97 months, the relative mortality was greater, even though there was a lesser

degree of overcrowding, than with the greatest overcrowding in January, 1849, and only in 19 months with a lesser overcrowding was a lesser relative mortality to be observed

The 19 months in which a lesser relative mortality with a lessened overcrowding was observed, are shown in Table No. XLI.

But if we consider not only the degree of overcrowding, but at the same time the season of the year, then we find that, with the exception of the two months, March and April, in the remaining ten months of the year, the greatest absolute mortality did not occur simultaneously with the greatest overcrowding as Table No XLII shows

Month Year Mothers Deaths Births Less Tan 1849 403 2 23 9 Nov 1848 310 2 90 93 9 Oct 1848 7 104 2 34 299 Dec 1847 8 273 2 93 130 6 Tune 1847 268 2 38 135 9 8 Aug 1845 251 3 58 152 3 22 Oct 1844 248 155 6 June 1844 2 67 224 179 2 26 Sept 1843 221 5 182 July 1844 206 9 197 4 37 Tune 1843 196 4 08 207

TABLE XL

But if we consider the overcrowding and the season of the year, we find that the greatest relative mortality never occurs at the time of the greatest overcrowding, and that in six different months the smallest relative mortality happened exactly at the time of the greatest overcrowding, as Table No XLII shows

But if we arrange the same months from each year according to the degree of overcrowding, we find that, along with the gradual decrease in overcrowding, there is no gradual decrease in the mortality, as Table No XLIII shows

If we take the same months from each year according to the absolute mortality, we find that, corresponding to the gradual decrease in the absolute mortality, there is no corresponding

gradual decrease in the degree of overcrowding, as Table No XLIV shows.

But if we arrange the single months of the same season of the year according to the relative mortality, we find that, along with the gradual decrease in the relative mortality, there is no corresponding decrease in the degree of overcrowding, as Table No XLV shows

TABLE XLI

Month	Year	Births	Deaths	Pct	Births Less	Deaths Less
Jan.	1849	403	9	2 23		
Dec	1848	373	5	1 34	30	4
May	1848	313	3 6	0 99	90	6
Feb	1847	312	6	1 92	91	3
Sept	1848	312	3	0 96	91	6
Aprıl	1848	305	2	0 65	98	7
Feb	1848	291	2	0 68	112	7
March	1848	276		ļ	127	
July	1848	269	1	0 37	134	8
Aug	1847	264	5	1 98	139	4
June	1848	264	5 3	1 13	139	6
Aug	1848	261		_	142	[
Aprıl	1841	255	4	1 57	148	5
May	1841	255	2	0 78	148	7
July	1847	250	3	I 20	153	6
Sept	1844	245	3	1 22	158	6
Aug	1841	222	3	1 35	181	6
Sept	1841	213	4	1 87	190	5
Aug	1843	193	3	1 55	210	6
July	1843	191	1	0 52	212	8

If we arrange all the 97 months according to the number of births, 1 e. according to the degree of overcrowding, we find no gradual decrease of the mortality corresponding to the gradual decrease of overcrowding, as Table No. XLVI shows

(p 238) If we arrange all 97 months according to the absolute mortality, then we find along with the gradual decrease of the absolute mortality no gradual decrease in the number of births, or in other words, no corresponding gradual decrease in the degree of overcrowding as Table No XLVII shows

TABLE XLI

		TABL	E XLII		
Year	Births	Deaths	Pct	Births Less	Deaths Mon
		Jar	nuary		
1849	403	9	2 23	}	
1846	336	45	13 39	67	36
1847	311	10	3 21	92) I
1842	307	64	20 84	96	55
1845	303	23	7 59	100	14
1848	283	10	3 53	120	I
1843	272	52	19 11	131	43
1841	254	37	14 46	149	28
1844	244	37	15 16	159	28
		Feb	ruary	···	
1849	389	12	3 08	1	
1842	311	38	12 21	78	26
1846	293	53	18 08	96	41
1845	274	13	5 11	115	ı
1843	263	42	15 96	126	30
1844	257	29	11 28	132	17
1841	239	18	7 53	150	6
		M	arch	******	7
1846	311	48	15 43		
	·	A	prıl	<u></u>	<u> </u>
1847	312	57	18 27		
	<u></u>	N	Iay	·····	<u> </u>
1848	313	3	0 99	1	
1842	310	10	3 22	3	7
1846	305	41	13 44	17	10
1845	296	13	4 39	17	10
1847	294	36	12 24	19	33
1843	246	15	6 10	67	12
1844	240	14	5 83	73	11
		J ₁	ıne		
1845	280	20	7 14		
1846	266	27	10 15	14	7
		J	uly		<u></u>
1848	269	ı	o 37		
1846	252	33	13 10	17	32
1847	250	3	I 20	19	2
1845	245	15	6 12	24	14
1842	231	48	20 79	38	47
1844	206	9	4 37	63	8
1841	190	16	8 42	79	15

TABLE XLII—Concluded

Year	Births	Deaths	Pct	Births Less	Deaths Mor
		Au	gust		
1844	269	17	6 32		
1846	216	39	18 05	53	22
1842	216	55	25 46	53	38
		Sept	ember		
1848	312	3	0 96		
1846	271	39	14 39	41	36
1847	262	12	5 22	50	9
1845	237	25	10 55	75	22
1842	223	41	18 38	89	38
1843	221	5	2 26	91	2
1841	213	4	1 87	99	1
		Oc	tober		
1848	299	7	2 34	1	
1845	283	42	14 84	16	35
1847	278	II	3 95	21	4
1846	254	38	14 98	45	31
1843	250	44	17 60	49	37
1844	248	8	3 22	51	ı ı
1842	242	71	29 33	57	64
1841	236	26	11 00	63	19
		Nov	rember		
1848	310	9	2 90		1
1846	297	32	10 77	13	23
1845	265	29	10 94	45	20
1843	252	18	7 14	58	9
1847	246	11	4 47	64	2
1844	245	27	11 00	65	18
1841	235	53	22 55	75	44
1842	209	48	22 96	101	39
		De	cember		
1848	273	5	1 34		
1846	298	16	5 37	75	11
1847	273	8	2 93	100	3
1845	267	28	10 48	106	23
1844	256	27	10 55	117	22
1842	239	75	31 38	134	70
1042					

If we arrange the 97 months according to the relative mortality, we find no decrease in the number of births nor any decrease in

TABLE XLIII

Year	Births	Deaths	Pct	Births Less	Year	Births	Deaths	Pct	Births Less
		January	,				June		
1849	403	9	2 23	}	1845	280	20	7 14	
1846	336	45	13 39	67	1846	266	27	10 15	14
1847	311	10	3 21	92			July		
1842	307	64	20 84	96			July		
1845	303	23	7 59	100	1848	269	I	o 37	
1848	283	10	3 53	120	1846	252	33	13 10	17
1843	272	52	19 11	131	1847	250	3	I 20	19
1841	254	37	14 46	149	1845	245	15	6 12	24
1844	244	37	15 16	159	1842	231	48	20 79	38
		r 1		`	1844	206	9	4 37	63
		February	7		1843	191	I	0 52	78
.0	000	1 70	3 08	1	1841	190	16	8 42	79
1849 1842	389	12	3 08 12 21	70			August		
1846	311	38	18 08	78 96			August		
1845	² 93	53	5 11	115	1844	269	17	6 32	
1843	263	42	15 96	126	1846	216	39	18 05	53
1844	257	29	11 28	132	1842	216	55	25 46	53
1841	239	18	7 53	150		<u>'</u>	Septembe	···	
							reptenio	· A	
		March			1848	312	3	0 96	1
-0.6	1	.0		i	1846	271	39	14 39	41
1846	311	48	15 43		1847	262	12	5 ² 3	50
1844	276	47	17 03	35	1844	245	3	I 22	67
		Aprıl			1845	237	25	10 55	75
				,	1842	223	41	18 38	89
1847	312	57	18 27		1843	221	5	2 26 1 87	91
1846	253	48	18 97	59	1841	213	4	1 0/	99
	<u>'</u>	May	·	`			October		
				·	1848	299	7	2 34	
1848	313	3	0 99	1	1845	283	42	14 84	16
1842	310	10	3 22	3	1847	278	11	3 95	21
1846	305	41	13 44	8	1846	254	38	14 98	45
1845	296	13	4 39	17	1843	250	44	17 60	49
1847	294	36	12 20	19	1844	248	8	3 22	51
1843	246	15	6 10	67	1842	242	71	29 33	57
1844	240	14	5 83	73	1841	236	26	11 00	63

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Year	Births	Deaths	Pct	Births Less	Year	Births	Deaths	Pct	Births Less
]	Novemb	er				Decembe	r	
1848	310	9	2 90		1848	373	5	1 34	1
1846	297	32	10 77	13	1846	298	18	5 37	75
1845	265	29	10 94	45	1847	273	8	2 93	100
1843	252	18	7 14	58	1845	267	28	10 48	106
1847	246	11	4 47	64	1844	256	27	10 55	117
1844	245	27	11 00	65	1842	239	75	31 38	134

TABLE XLIII—Concluded

the degree of overcrowding, corresponding to the decrease in the relative mortality, as Table No XLVIII shows

1842

1841

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If we examine the annual report of the 26 years of the existence of the First Obstetrical Clinic, viz from 1833 to 1858 inclusive, in relation to overcrowding, we find that during 13 years the absolute mortality was greater during the time when it was least overcrowded, than it was at the time of the greatest overcrowding in 1852 with 4471 births, as Table No XLIX shows

If we consider the relative mortality, we find that during 16 years it was greater at the time of a lesser overcrowding, than at the time of the greatest overcrowding in 1852, as Tables L and LI show

During nine years, along with a decreased overcrowding, there was also a diminished mortality, but with the exception of the year 1838, the eight remaining years came after the introduction of the chlorine washings, as shown by Table No LI

If we arrange the single years according to the degree of overcrowding, we find, corresponding to the decrease of overcrowding, no gradual decrease of mortality, as Table No LII shows

If we arrange the single years according to the absolute mortality, we find no decrease in the degree of overcrowding corresponding to the decrease of the absolute mortality, as shown by Table LIII

If we arrange the single years according to the relative mortality, we find no decrease of the overcrowding corresponding to the decrease of the relative mortality, as shown by Table No LIV.

TABLE XLIII*

					VIIII.				
Year	Births	Deaths	Pct	Births Less	Year	Births	Deaths	Pct	Births Less
		January					May		
1849	403 336	9 45	2 33 13 39	67	1848	313	3	o 99 3 22	3
1847 1842	311	10 6.	3 21 20 84	92	1846	305	41	13 44	8
1845	307	64		96	1845	296	13	4 39	17
1848	303	23	7 59	100	1847	294	36	12 24	19
1843	283	10	3 53 19 11	120	1841	255	2	0 78	58
1841	272	52 27	19 11 14 46	131	1843	246	15	6 10	67
1844	254	37	14 40	149	1844	240	14	5 83	73
1044	244	37	<u> </u>	159			Υ	·	
		February	<u> </u>				June		
1849	389	12	3 08		1845	280	20	7 14	}
1847	312	6	1 92	77	1842	273	18	6 60	7
1842	311	38	12 21	78	1847	268	6	2 38	12
1846	293	53	18 18	96	1846	266	27	10 15	14
1848	291	2	o 68	98	1848	264	3	1 13	16
1845	274	13	5 11	115	1844	224	6	2 67	56
1843	263	42	15 96	126	1841	200	10	5 00	80
1844	257	29	11 28	132	1843	196	8	4 08	84
1841	239	18	7 53	150			T 1		
		March			l		July		1
1846	311	48	15 43		1848	269	1	0 37	
1847	305	11	3 60	6	1846	252	33	13 10	17
1845	292	13	4 45	19	1847	250	3	1 20	19
1841	² 77	12	4 33	34	1845	245	15	6 12	24
1844	276	47	17 03	35	1842	231	48	20 79	38
1848	276	0	0 00	35	1844	206	9	4 37	63
1843	266	33	12 40	45	1843	191	I	0 52	7 ⁸
1842	264	27	10 23	47	1841	190	16	8 42	79
 -		Aprıl					August		
1847	312	57	18 27		1844	269	17	6 32	
1848	305	2	0 65	7	1847	264	5	1 89	5
1843	285	34	11 93	27	1848	261	o l	0 00	8
1845	260	11	4 23	52	1845	251	9	3 58	18
1841	255	4	I 57	57	1841	222	3	I 35	47
	253	48	18 97	59	1846	216	39	18 05	53
1040									53
1846	242	26	10 74	70	1842 1843	216	55	25 46	76

^{*}In the original edition there are two tables XLIII —E C K

TABLE XLIII*-Concluded

Year	Births	Deaths	Pct	Births Less	Year	Births	Deaths	Pct	Births Less
		Septembe	er]	Novembe	 er	
1848 1846 1847 1844 1845 1842 1843	312 271 262 245 237 223 221 213	3 39 12 3 25 41 5	o 96 14 39 5 23 1 22 10 55 18 38 2 26 1 87	41 50 67 75 89 91 99	1848 1846 1845 1843 1847 1844 1841 1842	310 297 265 252 246 245 235 209	9 32 29 18 11 27 53 48	2 90 10 77 10 94 7 14 4 47 11 00 22 55 22 96	13 45 58 64 65 75
		October]	Decembe	r	
1848 1845 1847 1846 1843 1844 1842	299 283 278 254 250 248 242 236	7 42 11 38 44 8 71 26	o 96 14 84 3 95 14 98 17 60 2 22 29 33 11 00	16 21 45 49 51 57 63	1848 1846 1847 1845 1844 1842	373 298 273 267 256 239 236	5 16 8 28 27 75	1 34 5 37 2 93 10 48 10 55 31 38 8 05	75 100 106 117 134 137

(p. 247) In the Second Obstetrical Clinic the greatest over-crowding, during the 26 years of its existence, occurred in 1858. In this year, there were cared for 4179, of whom 60 died, or 1 43%, in 20 years the absolute mortality was greater with the lesser overcrowding, as Table No LV shows

If we consider the relative mortality, we find, that during 23 years it was greater in the presence of a lesser overcrowding, than it was at the time of the greatest overcrowding in 1858, as shown by Table No LV and LVI

(p 248) In two years only was there a lesser mortality in the presence of a lesser overcrowding, than at the time of the greatest overcrowding in and 1858, viz.

Year	Year Births		Pct	Births Less
1858 1847 1848	4 ¹ 79 3306 3219	60 32 43	1 43 0 96 1 33	873 960

TABLE XLIV

Year	Deaths	Pct	Births	Year	Deaths	Pct	Birth
	Janu	ıary			Ma	ıy	·
1842	64	20 84	307	1846	41	13 44	305
1843	52	19 11	272	1847	36	12 24	294
1846	45	13 39	336	1843	15	6 10	246
1844	37	15 16	244	1844	14	5 83	240
1841	37	14 56	254	1845	13	4 39	296
1845	23	7 59	303	1842	10	3 22	310
1847	10	3 21	311	1848	3	0 99	313
1848	10	3 53	283	1841	2	0 78	255
1849	9	2 23	403				
	Febr	uary			Jur	1e 	
1846	53	18 08	293	1846	27	10 15	266
1843	42	15 96	263	1845	20	7 14	280
1842	38	12 21	311	1842	18	6 60	272
1844	29	11 28	257	1841	10	5 00	200
1841	18	7 59	239	1843	8	3 °3	296
1845	13	5 17	274	1844	6	2 57	224
1849	12	3 08	389	1847	6	2 38	268
1847	6	1 92	312	1848	3	0 99	313
1848	2	0 68	291		T. J.		
	Mai	rch			Jul	y 	
1846	48	75.42	277	1842	48	20 79	231
1844 1844	4	15 43	311	1846	33	13 16	252
1843	47	17 03	276 266	1841	16	8 42	190
1842	33	12 40	264	1845	15	6.12	245
1845	27	10 23	292	1844	9	4 37	206
1841	13	4 45	260	1847	3	1 20	250
1847	11	4 33 3 60	305	1843	I	0 52	191
1848	0	0 00	276	1848	I	o 37	269
	Ap	rıl			Augu	ıst	
1847	57	18 27	312	1842	55	25 46	216
1846	48	18 97	253	1846	39	18 05	216
1844	36	17 30	208	1844	17	6 32	269
1843	34	11 90	285	1845	9	3 68	251
1842	26	10 74	242	1847	5	1 89	264
1845	11	4 23	260	1843	5 3	1 55	193
1841	4	1 57	255	1841	3	1 35	222
1848	2	0 65	305	1848	0	0 00	261

TABLE XLIV-Concluded

Year	Deaths	Pct	Births	Year	Deaths	Pct	Birth
	Septe	mber			Nove	mber	
1842	41	18 38	223	1841	53	22 55	235
1846	39	14 39	271	1842	48	22 96	209
1845	25	10 55	237	1846	32	10 77	297
1847	12	5 23	262	1845	29	10 44	265
1843	5	2 26	221	1844	27	11 00	245
1841	4	1 87	213	1843	18	7 14	252
1844	3	1 22	245	1847	II	4 47	246
1848	3	0 96	312	1848	9	2 90	310
	Octo	ber			Decen	nhan	
1842	71	29 33	242		, Decei	ilibei	
1843	44	17 60	250	1842	75	31 38	239
1845	42	14 84	238	1845	28	10 48	267
1846	38	14 38	254	1844	27	10 55	256
1841	26	11 00	236	1843	19	8 05	236
1847	II	3 95	278	1846	16	5 57	298
1844	8	3 22	248	1847	8	2 93	273
1848	7	2 34	299	1848	5	I 34	273

If we arrange the single years according to the degree of overcrowding in the Second Obstetrical Clinic, we find no decrease of the mortality corresponding to the decrease of the overcrowding, as Table LVII shows

(p 249) If we arrange the single years in the Second Obstetrical Clinic according to the absolute mortality, we find no decrease in the degree of overcrowding, corresponding to the decrease in the absolute mortality, as Table No LVIII shows

Likewise, there is no gradual decrease in the overcrowding, corresponding to the gradually decreasing relative mortality, as Table No LIX shows

The greatest overcrowding of the Vienna Lying-in Hospital, taken as a whole during the 75 years of its existence, occurred in 1858 During this year, there were cared for 8382 puerperae, of whom 146 died, or 147% And during 28 years, the absolute mortality was the greatest at the time of the lesser overcrowding, as is shown in Table No LX

If we consider the relative mortality, during 43 years we find

TABLE XLV

Year	Pct	Deaths	Births	Year	Pct	Deaths	Births	
	Janu	iary			M	ay		
1842	20 84	64	307	1846	13 44	41	305	
1843	19 11	52	272	1847	12 24	36	294	
1844	15 16	37	244	1843	6 10	15	246	
1841	14 56	37	254	1844	5 83	14	240	
1846	13 39	45	336	1845	4 39	13	296	
1845	7 59	23	303	1842	3 22	10	310	
1848	3 53	10	283	1848	0 99	3	313	
1847	3 21	10	311	1841	0 78	2	255	
	Febr	uary		June				
1846	18 08	53	293	1846	1		266	
1843	15 96	42	263		10 15	27	280	
1842	12 21	38	311	1845	7 14 6 60	20		
1844	11 28	29	257	1842	1	18	² 73	
1841	7 53	18	239	1841	5 00	10	200	
1845	5 11	13	274	1843	4 08	8	196	
1849	3 08	12	389	1844	2 67	6 6	224 268	
1847	1 92	6	312	1847	2 38			
1848	0 68	2	291	1848	1 13	3	264	
	Mai	rch			Jul	У		
1844	17 03	47	276	1842	20 79	48	231	
1846	15 43	48	311	1846	13 10	33	252	
1843	12 49	33	266	1841	8 42	16	190	
1842	10 33	27	264	1845	6 12	15	245	
1845	4 45	13	292	1844	4 37	9	206	
1841	4 33	12	277	1847	1 20	3	250	
1847	3 60	11	305	1843	0 52	1	191	
1848	0 00	0	276	1848	0 37	1	269	
	Ap	nl			Aug	ıst		
1846	18 97	48	253	1842	25 46	55	216	
1847	18 27	57	312	1846	18 05	39	216	
1844	17 30	36	208	1844	6 32	17	269	
1843	11 93	34	285	1845	3 58	9	251	
1842	10 74	26	242	1847	1 89	5	264	
1845	4 23	11	260	1843	1 55	3	193	
1841	1 57	4	255	1841	1 35	3	223	
1848	0 65	2	305	1848	0 00	0	261	

TABLE XLV-Concluded

Year	Pct	Deaths	Births	Year	Pct	Deaths	Births
	Septe	mber		·····	Nove	mber	
1842 1846 1845 1847 1843 1841 1844	18 38 14 39 10 55 5 23 2 26 1 87 1 22 0 96	41 39 25 12 5 4 3	223 271 237 262 221 213 245 312	1842 1841 1844 1845 1846 1843 1847	22 96 22 55 11 00 10 94 10 77 7 14 4 47 2 90	48 53 27 29 32 18	209 235 245 265 297 252 246 310
	Octo	ber			Dece	nber	
1842 1843 1846 1845 1841 1847 1844	29 33 17 60 14 98 14 84 11 00 3 95 1 22 0 96	71 44 38 42 20 11 3	242 250 254 283 236 278 245 312	1842 1844 1845 1843 1846 1847	31 38 10 55 10 48 8 05 5 37 2 93 1 34	75 27 28 19 16 8	239 256 267 236 298 273

it greater at the time of the lesser overcrowding, than at the time of the greatest overcrowding in 1858, as is shown by Tables No. LX and LXI.

If we arrange the 75 years of the Vienna Lying-in Hospital, with the combined figures of the two divisions, according to the degree of overcrowding, we find no connection between overcrowding and mortality, as Table No. LXII shows

If we arrange the 75 years of the Vienna Lying-in Hospital according to the absolute mortality, we find no relation between overcrowding and absolute mortality as Table No. LXIII shows.

If we arrange the single years according to the relative mortality, we find no relation between the overcrowding and the relative mortality, as Table No LXIV shows

In our critical examination of the hitherto accepted etiology of childbed fever in its application to the explanation of the greater mortality in the First Obstetrical Clinic in contrast with the Second, we have not mentioned the "puerperal miasma," because it was never used in the First Clinic as an explanation of

TABLE XLVI

Month	Year	Births	Deaths	Pet	Births Le
Jan	1849	403	9	2 23	
Feb	1849	389	12	3 08	14
Dec	1848	373	5	1 34	30
Jan	1846	336	45	13 39	67
May	1848	313	3	0 99	90
Aprıl	1847	312	57	18 27	91
Feb	1847	312	6	1 92	9r
Sept	1848	312	3	0 96	9 r
March	1846	311	48	15 43	92
Jan	1847	311	10	3 21	92
Feb	1842	311	38	12 21	92
May	1842	310	10	3 22	93
Nov	1848	310	9	2 90	93
Jan	1842	307	64	20 84	96
May	1846	305	41	13 44	98
Mar	1847	305	111	3 60	98
Aprıl	1848	305	2	0 65	98
Jan	1845	303	23	7 59	100
Oct	1848	299	7	2 34	104
Dec	1846	298	16	5 37	105
Nov	1846	297	32	10 77	106
May	1845	296	13	4 39	107
May	1847	294	36	12 24	109
Feb	1846	293	53	18 08	110
Mar	1845	292	13	4 45	111
Feb	1848	291	2	0 68	112
Aprıl	1843	285	34	11 93	118
Oct	1845	283	42	14 84	120
Jan	1848	283	10	3 53	120
June	1845	280	20	7 14	123
Oct	1847	278	11	3 95	125
Mar	1841	277	12	4 33	126
Mar.	1844	276	47	17.03	127
Mar	1848	276		0 00	127
Feb	1845	274	13	5 11	129
June	1842	² 73	18	6 60	130
Dec	1847	² 73	8	2 93	130
Jan	1843	272	52	19 11	131
Sept	1846	271	39	14 39	132
Aug	1844	269	17	6 32	134
July	1848	269	1	0 37	134
June	1847	268	6	2 38	135
Dec	1845	267	28	10 48	136
Mar.	1843	266	33	12 40	137
June	1846	266	27	10 15	137

		TABLE XL	TABLE XLVI—Concluded												
Month	Year	Births	Deaths	Pct	Births Less										
Nov	1845	265	29	10 94	138										
Mar	1842	264	27	10 23	139										
Aug	1847	264	5	1 89	139										
June	1848	264	3	1 13	139										
Feb	1843	263	42	15 96	140										
Sept	1847	262	12	5 23	141										
Aug	1848	261	0	0 00	142										
Aprıl	1845	260	11	4 23	143										
Feb	1844	² 57	29	11 28	146										
Dec	1844	256	27	10 55	147										
Aprıl	1841	255	4	1 57	148										
May	1841	255	2	0 78	148										
Jan	1841	254	37	14 46	149										
Oct	1846	254	38	14 98	149										
Aprıl	1846	253	48	18 97	150										
Nov	1843	252	18	7 14	151										
July	1846	252	33	13 10	151										
Aug	1845	251	9	3 58	152										
Oct	1843	250	44	17 60	153										
July	1847	250	3	1 20	153										
Oct	1844	248	8	3 22	155										
May	1843	246	15	6 10	157										
Nov	1847	246	11	4 47	157										
July	1845	245	15	6 12	158										
Nov	1844	245	27	11 00	158										
Sept	1844	245	3	1 22	158										
Jan	1844	244	37	15 16	159										
April	1842	242	26	10 74	161										
Oct	1842	242	71	29 33	161										
May	1844	240	14	5 83	163										
Feb	1841	239	18	7 53	164										
Dec	1842	239	75	31 38	164										
Sept	1845	237	25	10 55	166										
Oct	1841	236	26	11 00	167										
Dec	1843	236	19	8 05	167										
Nov	1841	235	53	22 55	168										
July	1842	231	48	20 79	172										
June	1844	224	6	2 67	179										
Sept	1842	223	4 ^I	18 38	180										
Aug	1841	222	3	1 35	181										
Sept	1843	221	5	2 26	182										
Aug	1846	216	39	18 05	187										
Aug	1842	216	55	25 46	187										
Sept	1841	213	4	1 87	190										
Nov	1842	209	48	22 96	194										
Aprıl	1844	208	36	17 30	195										
July	1844	206	9	4 37	197										
June	1841	200	10	5 00	203										
June	1843	196	8	4 08	207										
\mathbf{Aug}	1843	193	3	I 55	210										
July	1843	191	I	0 52	212										
July	1841	190	16	8 42	213										

TABLE ALVII									
Month	Year	Deaths	Pct	Births	Month	Year	Deaths	Pct	Births
Dec	1842	75	31 38	239	Dec	1846	16	5 57	298
Oct	1842	71	29 33	242	July	1845	15	6 12	245
Jan	1842	64	20 84	307	May	1843	15	6 10	246
Apr	1847	57	18 27	312	May	1844	14	5 83	240
Aug	1842	55	25 46	216	Feb	1845	13	5 17	274
Nov	1841	53	22 55	235	Mar	1847	13	1	292
Feb	1846	53	18 08	293	May	1845	13	4 45	296
Jan	1843	53 52	19 11	272	Mar	1841	12	4 39	260
Nov	1842	48	22 96	209	Sept	1847	12	4 33	262
July	1842	48	20 79	231	Feb	1849	12	5 23 3 08	389
Apr	1846	48	_		Mar	1847	1		
Mar	1846	48	1 - 1	253	Oct	1047	11) •	305
Mar	1844	1	15 43	311	1	1847	11	3 95	278
	1846	47	17 03	276	Apr	1845	11	4 23	260
Jan Ost		45	13 39	336	Nov	1847	11	4 47	246
Oct	1843	44	17 60	250	June	1841	10	5 00	200
Feb	1843	42	15 96	263	May	1842	10	3 22	310
Oct	1845	42	14 84	283	Jan	1847	10	3 21	311
Sept	1842	41	18 38	223	Jan	1848	10	3 53	283
May	1846	41	13 44	305	July	1844	9	4 37	206
Aug	1846	39	18 05	216	Aug	1845	9	3 68	251
Sept	1846	39	14 39	271	Nov	1848	9	2 90	310
Oct	1846	38	14 38	254	Jan	1849	9	2 23	403
Feb	1842	38	12 21	311	June	1843	8	3 03	296
Jan	1844	37	15 16	244	Oct.	1844	8	3 22	248
Jan	1841	37	14 56	254	Dec	1847	8	2 93	² 73
Apr	1844	36	17 30	208	Oct	1848	7	2 34	299
May	1847	36	12 24	294	June	1844	6	2 62	224
Apr	1843	34	11 00	285	Feb	1847	6	1 92	312
July	1846	33	13 16	252	June	1847	6	2 38	268
Mar	1843	33	12 40	266	Sept	1843	5	2 26	221
Nov	1846	32	10 77	² 97	Aug	1847	5	1 89	264
Feb	1844	29	11 28	² 57	Dec	1848	5	I 34	373
Nov	1845	29	10 44	267	Sept	1841	4	1 87	213
Dec	1845	28	10 48	267	Apr	1841	4	1 57	255
Dec	1844	27	10 55	256	Aug	1843	3	I 55	193
Nov	1844	27	11 00	245	Aug	1841	3	1 35	222
Mar	1842	27	10 23	264	Sept	1841	3	I 22	245
June	1846	27	10 15	266	July	1847	3	I 20	250
Oct	1841	26	11 00	236	May	1848	3	0 99	313
Apr	1842	26	10 74	242	June	1848	3	1 13	264
Sept	1845	25	10 55	237	Sept	1848	3	0 96	312
Jan	1845	23	7 59	303	May	1841	2	0 78	255
Jun	1845	20	7 14	280	Feb	1848	2	0 68	291
Dec	1843	19	8 05	236	Apr	1848	2	0 65	305
Feb	1841	18	7 59	239	July	1843	1	0 52	191
Nov	1843	18	7 14	252	July	1848	I	0 37	269
June	1842	18	6 60	272	Mar	1848	0	0 00	276
Aug	1844	17	6 32	269	Aug	1848	0	0 00	261
July	1841	16	8 42	190					

TABLE XLVIII

Month	Year	Pct	Deaths	Births	Month	Year	Pct	Deaths	Births
Dec	1842	31 38	75	239	July'	1845	6 12	15	245
Oct	1842	29 33	71	242	May	1843	6 10	15	246
Aug	1842	25 46	55	216	May	1844	5 83	14	240
Nov	1842	22 96	48	209	Dec	1846	5 37	16	298
Nov	1841	22 55	53	235	Sept	1847	5 23	12	262
Jan	1842	20 84	64	307	Feb	1845	5 23 5 II	13	274
July	1842	20 79	48	231	June	1841	5 09	10	200
Jan	1843	19 11	52	272	Mar	1845		1	
Apr	1846	18 97	48	253	Nov	1847	4 45 4 47	13 11	292 246
Sept	1842	18 38	4I	223	May	1845	4 39		296
Apr	1847	18 27		312	July	1844		13	206
Feb	1846	18 08	57	-	Apr	1845	4 37	9	260
Aug	1846	18 05	53	293 216	Mar	1841	4 23	11	
Oct	1843	17 60	39		June	1843	4 33 4 08	12 8	277
	1844	1 .	44 36	250 208	Oct	1847	-		296
Apr Mar	1844	17 30			Mar	104/	3 95	11	278
		17 03	47	276	Aug	1847	3 60	11	305
Feb Mar	1843	15 96	42	263		1845	3 58	9	251
	1846	15 43	48	311	Jan	1848	3 53	10	283
Jan	1844	15 16	37	244	May	1842	3 22	10	310
Oct	1846	14 98	38	254	Oct	1844	3 22	8	248
Oct	1845	14 84	42	283	Jan	1847	3 21	10	311
Jan	1841	14 56	37	254	Feb	1849	3 08	12	389
Sept	1846	14 19	39	271	Dec	1847	2 93	8	² 73
May	1846	13 44	4 ^I	305	Nov	1848	2 90	9	310
Jan	1846	13 39	45	336	June	1844	2 67	6	224
July	1846	13 10	33	252	June	1847	2 38	6	268
Mar	1843	12 49	33	266	Oct	1848	2 34	7	299
May	1847	12 24	36	294	Sept	1843	2 26	5	221
Feb	1842	12 21	38	311	Jan	1849	2 23	9	403
Apr	1843	11 93	34	285	Feb	1847	1 92	6	312
Feb	1844	11 28	29	257	Aug	1847	1 89	5	264
Nov	1844	11 00	² 7	245	Sept	1841	ı 87	4	213
Oct	1841	11 00	26	236	Apr	1841	I 57	4	255
Nov.	1845	10 94	29	265	Aug	1843	I 55	3	193
Nov	1846	10 77	32	² 97	Aug	1841	I 35	3	223
Apr	1842	10 74	26	242	Dec	1848	I 34	5	373
Sept	1845	10 55	25	237	Sept	1844	I 22	3	245
Dec	1844	10 55	27	256	July	1847	I 20	3	250
Dec	1845	10 48	28	267	June	1848	1 13	3	264
Mar	1842	10 23	27	264	May	1848	0 99	3	313
June	1846	10 15	27	266	Sept	1848	0 96	3	312
July	1841	8 42	16	190	May	1841	0 78	2	255
Dec	1843	7 05	19	296	Feb	1848	o 68	2	291
Jan	1845	8 59	23	303	Apr	1848	0 65	2	305
Feb	1841	7 53	18	239	July	1843	0 52	I	191
June	1845	7 14	20	280	July	1848	0 37	I	269
Nov	1843	7 14	18	252	Mar	1848	0 00	0	276
June	1842	6 60	18	273	Aug	1848	0 00	0	261
Aug	1844	6 32	17	269				1	

the mortality Having set myself the task of criticizing the hitherto accepted etiology, outside of its relation to the First

TABLE XLIX

Year	Births	Deaths	Pct	Births Less	Deaths More
1852	4471	181	4 04		
1854	4393	400	9 10	78	219
1846	4010	459	11 44	461	278
1833	3737	197	5 29	734	16
1855	3659	198	5 41	812	17
1845	3492	241	6 90	979	60
1842	3287	518	15 75	1184	337
1844	3157	260	8 23	1314	79
1843	3060	274	8 95	1411	93
1841	3036	237	7 80	1435	56
1840	2889	267	9 24	1582	86
1837	2765	251	9 09	1706	70
1836	2677	200	7 47	1794	19
1834	2657	205	7 7 ¹	1814	24

TABLE L

Year	Births	Deaths	Pct	Births Less
1852	4471	181	4 04	981
1847	3490	176	5 04	
1839	2781	151	5 4 ²	1690
1835	2573	143	5 55	1898

TABLE LI

Year	Births	Deaths	Pct	Births Less	Deaths Less
1852	4471	181	4 04		
1853	4221	94	2 13	250	87
1857	4220	124	2 96	251	57
1858	4203	86	2 04	268	95
1851	4194	75	1 78	277	106
1856	3925	156	3 97	546	25
1849	3858	103	2 66	613	78
1850	3745	74	1 97	726	107
1848	3556	45	1 97	915	136
1838	2987	91	3 04	1484	90

Clinic, it is necessary to express my opinion of the "puerperal miasma"

TABLE LII

Year	Births	Deaths	Pct	Births Less	Year	Births	Deaths	Pct	Births Less
1852 1854 1853 1857 1858 1851 1846 1856 1849 1850 1833 1855	4471 4393 4221 4220 4203 4194 4010 3925 3858 3745 3737 3659	181 400 94 124 86 75 459 156 103 74 197	4 04 9 10 2 12 2 96 2 04 1 78 11 44 3 97 2 66 1 97 5 29 5 41	78 250 251 268 277 461 546 613 726 734 812	1845 1847 1842 1844 1843 1841 1838 1840 1839 1837 1836 1834	349 ² 3490 3 ²⁸ 7 3 ¹ 57 3060 3036 ² 987 ²⁸⁸ 9 ² 781 ² 765 ² 657	241 176 518 260 274 237 91 267 151 251 200	6 90 5 04 15 75 8 23 8 95 7 80 3 04 9 24 5 42 9 09 7 47 7 71	979 981 1184 1314 1411 1435 1484 1582 1690 1706 1794 1814
1848	3556	45	I 27	915	1835	² 573	143	5 55	1898

TABLE LIII

Year	Deaths	Pct	Births	Year	Deaths	Pct	Births
1842	518	15 75	3287	1852	181	4 04	4471
1846	459	11 44	4010	1847	176	5 04	3490
1854	400	9 10	4393	1856	156	3 97	3925
1843	274	8 95	3060	1839	151	5 42	2781
1840	267	9 24	2889	1835	143	5 55	2573
1844	260	8 23	3157	1857	124	2 96	4220
1837	251	9 09	2765	1849	103	2 66	3858
1845	241	6 90	3492	1853	94	2 13	4221
1841	237	7 80	3036	1838	91	3 04	2987
1834	205	7 71	2657	1858	86	2 04	4203
1836	200	7 47	2677	1851	75	1 78	4194
1855	198	5 41	3659	1850	74	1 97	3745
1833	197	5 29	3737	1848	45	1 27	3556

TABLE LIV

Year	Pct	Deaths	Births	Year	Pct	Deaths	Births
1842	15 75	518	3287	1855	5 41	198	3659
1846	11 44	459	4010	1833	5 29	197	3737
1840	9 24	267	2889	1847	5 04	176	3490
1854	9 10	400	4393	1852	4 04	181	4471
1837	9 09	251	2765	1856	3 97	156	3925
1843	8 95	274	3060	1838	3 04	91	2987
1844	8 23	260	3157	1857	2 96	124	4220
1841	7 80	² 37	3036	1849	2 66	103	3858
1834	7 71	205	2657	1853	2 13	94	4221
1836	7 47	200	2677	1858	2 04	86	4203
1845	6 90	241	3492	1850	1 97	74	3745
1835	5 55	143	2573	1851	1 78	75	4194
1839	5 42	151	2781	1848	1 27	45	3556

If in a ward there are a few or many puerperae with their nurslings, the atmospheric air of the lying-in room becomes permeated with the exhalations of increased skin-activity, milk-secretion, lochial discharge, etc., etc., and if these exhalations are

TABLE LV

Year	Births	Deaths	Pct	Births Less	Deaths More
1858	4179	60	I 43		
1857	3795	83	2 18	384	23
1846	3754	105	2 79	425	45
1853	3480	67	1 92	699	7
1854	3396	210	6 18	783	150
18 5 1	3395	121	3 56	784	61
1849	3371	87	2 58	808	27
1852	3360	192	5 71	819	132
1845	3241	66	2 03	938	6
1856	3070	125	4 07	1109	65
1844	2956	68	2 30	1223	8
1855	2938	174	5 92	1241	114
1843	2739	164	5 98	1440	104
1842	2659	202	7 59	1520	142
1841	2442	86	3 52	1737	26
1839	2010	91	4 52	2169	31
1837	1784	124	6 99	2395	64
1838	1779	88	4 94	2400	28
1834	1744	150	8 60	² 435	90
1835	1682	84	4 99	2497	24
1836	1670	131	7 84	2509	71

TABLE LVI

Year	Births	Deaths	Pct	Births Less
1858	4179	60	I 43	
1850	3261	54	1 65	918
1840	2073	55	265	2106
1833	353	8	2 26	3826

not promptly removed by ventilation, it will go on to a putrefying process, the newly developed putrefying process will cause childbed fever if it penetrates into the genital organs of the puerperae along with the atmospheric air

If in a ward there are one or more sick puerperae among the

healthy ones, and if their disease, whether puerperal fever or other disease, gives off decomposed matter, then this exhaled decomposed matter will cause childbed fever if it penetrates into

TABLE LVII

Year	Births	Deaths	Pct	Births Less	Year	Births	Deaths	Pct	Births Less
1858	4179	60	I 43		1844	2956	68	2 30	1223-
1857	3795	83	2.18	384	1855	2938	174	5 92	1241
1846	3754	105	2 79	425	1843	2739	164	5 98	1440
1853	3480	67	1 92	699	1842	2659	202	7 59	1520
1854	3396	210	6 18	783	1841	2442	86	3 52	1737
1851	3395	121	3 56	784	1840	2073	55	2 65	2106
1849	3371	87	2 58	808	1839	2010	91	4 52	2169
1852	3360	192	5 71	819	1837	1784	124	6 99	2395
1847	3306	32	0 96	973	1838	1779	88	4 94	2400
1850	3261	54	1 65	918	1834	1744	150	8 60	2435
1845	3241	66	2 03	938	1835	1682	84	4 99	2497
1848	3219	43	1 33	960	1836	1670	131	7 84	2509
1856	3070	125	4 07	1109	1833	353	8	2 26	3826

TABLE LVIII

Year	Deaths	Pct	Births	Year	Deaths	Pct	Births
1854	210	6 18	3396	1849	87	2 58	337I
1842	202	7 59	2659	1841	84	3 52	2442
1852	192	5 71	3360	1835	84	4 99	1682
1855	174	5 92	2938	1857	83	2 18	3795
1843	164	5 98	2739	1844	68	2 30	2956
1834	150	8 60	1744	1853	67	1 92	3480
1836	131	7 84	1670	1845	66	2 03	3241
1856	125	4 07	3070	1858	60	I 43	4179
1837	124	6 99	1784	1840	55	2 65	2073
1851	121	3 56	3395	1850	54	I 65	3261
1846	105	2 79	3754	1848	43	1 33	3219
1839	91	4 52	2010	1847	32	0 96	3306
1838	88	4 94	1779	1833	8	2 26	353

the genital organs of the healthy puerperae along with the atmos-

pheric air of the lying-in room

(p 259) If the foregoing is understood as "puerperal miasma," then I agree Anything beyond that does not exist as puerperal miasma

TABLE LIX

Year	Pct	Deaths	Births	Year	Pct	Deaths	Births
1834	8 60	150	1744	1841	3 52	86	2442
1836	7 84	131	1670	1846	2 79	105	3754
1842	7 59	202	2659	1840	2 65	55	2073
1837	6 99	124	1784	1849	2 58	87	3371
1854	6 18	210	3396	1844	2 30	68	2956
1843	5 98	164	2739	1833	2 36	8	353
1855	5 92	174	2938	1857	2 18	83	3795
1853	5 7x	192	3360	1845	2 03	66	3241
1835	4 99	84	1682	1853	1 92	67	3480
1838	4 94	88	1779	1850	1 65	54	3261
1839	4 52	91	2010	1858	I 43	60	4179
1856	4 07	125	3070	1848	1 33	43	3219
1851	3 56	121	3395	1847	0 96	32	3306

TABLE LX

Year	Births	Deaths	Pct	Births Less	Deaths More
1858	8383	146	I 74		
1857	8015	207	2 58	367	61
1852	7381	373	4 76	551	227
1854	7789	610	7 83	593	464
1853	7701	161	2 09	681	15
1851	7589	196	2 58	793	50
1849	7229	190	2 62	1153	44
1847	7039	210	2 98	1343	61
1846	7027	567	8 00	1355	421
18 <i>56</i>	6995	281	4 01	1387	135
1845	6756	313	4 63	1626	167
1855	6597	372	5 63	1785	226
1844	6244	336	5 38	2138	190
1842	6024	730	12 11	2358	584
1843	5914	457	7 72	2468	311
1841	5454	330	6 05	2928	184
1840	5166	328	6 44	3216	186
1839	4992	248	4 96	3390	102
1838	4560	179	3 92	3822	33
1837	4363	375	8 59	4019	229
1834	4218	355	8 41	4164	209
1836	4144	331	7 98	4238	185
1835	4040	227	5 61	4342	81
1833	3907	205	5 25	4475	59
1831	3353	222	6 62	5029	76
1819	3089	154	4 98	5293	8
1823	2872	214	7 45	5510	68
1825	2594	229	8 32	5788	83
1826	2359	192	8 12	6023	46

In order to prevent the decomposition of the above-named physiological exhalation, it is sufficient to ventilate by opening the windows

In order to prevent illness among the healthy puerperae from from the exhalation of decomposed matter from sick puerperae, the diseased puerperae must be isolated from the healthy ones

We have constructed many tables as proof that the state of health among the puerperae is independent of the degree of overcrowding, these tables are likewise many proofs against the

Year	Births	Deaths	Pct	Births Less
1858	8382	146	I 74	
1850	7006	128	I 82	1376
1832	3331	105	3 15	5051
1829	3012	140	4 64	5370
1820	2998	75	2 50	5384
1824	2911	144	4 94	5471
1828	2833	101	3 56	5546
1830	² 797	111	3 97	5585
1818	2568	56	2 18	5814
1827	2367	51	2 15	6015
1800	2070	41	1 98	6312
1814	2062	66	3 20	6320
1795	1798	38	2 11	6614
1793	1684	44	2 61	6698
1811	1050	20	1 90	733 ²
1784	284	6	2 11	8098

TABLE LXI

opinions on the origin of puerperal miasma which assume that the origin of the puerperal miasma stands in a necessary causative relation with the number of puerperae present

As proof that there is no puerperal miasma which necessarily must develop in the presence of a certain number of puerperae, will serve the fact that I have been able to strikingly diminish the mortality at the First Clinic without recourse to preventive measures suitable for the destruction of puerperal miasma. The prophylaxis against childbed fever was washing the hands with chlorine solution which was employed in the labor-room.

Since puerperal fever produces no contagium and a miasma,

TABLE LXII

Year	Births	Deaths	Pct	Births Less	Year	Births	Deaths	Pct	Births
	<u></u>	l	ļ						Less
1858	8382	146	1 54		1825	2594	229	8 82	5788
1857	8015	207	2 58	367	1815	2591	19	0 73	5791
1852	7831	373	4 76	551	1818	2568	56	2 18	5814
1854	7789	610	7 83	593	1816	2410	12	0 49	5972
1853	7701	161	2 09	681	1827	2367	51	2 15	6015
1851	7589	196	2 58	793	1826	2359	192	8 12	6023
1849	7229	190	2 62	1153	1802	2346	9	0 38	6036
1848	7095	91	1 28	1287	1803	2215	16	0 72	6167
1847	7039	210	2 98	1343	1805	2112	9	0 40	6270
1846	7027	567	8 06	1355	1801	2106	17	0 80	6276
1850	7006	128	1 82	1376	1800	2070	41	198	6312
1856	6995	281	4 01	1387	1799	2067	20	0 96	6315
1845	6756	313	4 63	1626	1814	2062	66	3 20	6320
1855	6597	372	5 63	1785	1798	2046	5	0 24	6336
1844	6244	336	5 38	2138	1804	2022	8	0 39	6360
1842	6024	730	12 11	2358	1797	2012	5	0 24	6370
1843	5914	457	7 72	2468	1813	1945	21	1 08	6437
1841	5454	330	6 05	2928	1796	1904	22	1 16	6478
1840	5166	328	6 44	3216	1806	1875	13	o 73	6507
1839	4992	248	4 96	3390	1795	1798	38	2 11	6614
1838	4560	179	3 92	3822	1794	1768	7	0 39	6644
1837	4363	375	8 59	4019	1793	1684	44	2 61	6698
1834	4218	355	8 41	4164	1792	1574	14	0 89	6808
1836	4144	331	7 98	4238	1788	1425	5	0 35	6957
1835	4040	227	5 61	4342	1812	1419	9	0 63	6963
1833	3907	205	5 25	4475	1787	1407	5	0 35	6975
1831	3353	222	6 62	5029	1791	1395	8	o 57	6987
1832	3331	105	3 15	5051	1790	1326	10	0 75	7056
1821	3294	55	1 66	5088	1789	1246	7	0 56	7136
1819	3089	154	4 98	5293	1786	1151	5	o 43	7231
1822	3066	26	0 84	4316	1811	1050	20	1 90	7327
1829	3012	140	4 64	5370	1807	925	6	0 64	7457
1820	2998	75	2 50	5384	1809	912	13	1 42	7470
1824	2911	144	4 94	5471	1785	899	13	I 44	7483
1823	2872	214	7 45	5510	1808	855	7	0 81	74 ² 7
1828	2833	101	3 56	5549	1810	744	6	0 80	7638
1830	2797	111	3 97	5585	1784	284	6	2 11	8098
1817	² 735	25	0 91	5647				1	

only in the sense indicated above, and cannot be contracted through an uninjured, external surface of the body, it is obvious that puerperal fever is not capable of so infecting the locale of a

TABLE LXIII

			111011	. LA111			
Year	Deaths	Pct	Births	Year	Deaths	Pct.	Births
1842	730	12 11	6024	1818	56	2 18	2568
1854	610	7 83	7789	1821	55	1 66	3294
1846	567	8 06	7027	1827	51	2 15	2367
1843	457	7 12	5914	1793	44	2 61	1684
1837	375	8 59	4363	1800	41	1 98	2070
1852	373	4 76	7381	1795	4 I	198	1798
1855	372	5 63	6597	1822	26	0 84	3066
1834	355	8 41	4218	1817	25	0 91	² 735
1844	336	5 38	6244	1796	22	1 16	1904
1836	331	7 98	4144	1813	21	1 08	1945
1841	330	6 05	5454	1811	20	1 90	1050
1840	328	6 44	5166	1799	20	0 96	2067
1845	313	4 63	6756	1815	19	o 73	2591
1856	281	4 01	6995	1801	17	0 80	2106
1839	248	4 96	4992	1803	16	0 72	2215
1825	229	8 82	2594	1792	14	0 89	1574
1835	227	5 61	4040	1809	13	I 42	912
1831	222	6 62	3353	1785	13	I 44	899
1823	214	7 45	2872	1806	13	o 73	1875
1847	210	2 98	7039	1816	12	0 49	2410
1857	207	2 58	8015	1790	10	o 75	1326
1833	205	5 25	3907	1812	9	0 63	1419
1851	196	2 58	7589	1805	9	0 40	2112
1826	192	8 12	2359	1802	9	0 38	2346
1849	190	2 62	7229	1804	8	0 39	2022
1838	179	3 92	4560	1791	8	o 57	1395
1853	161	2 09	7701	1794	7	0 39	1768
1819	154	4 08	3089	1789	7	0 56	1246
1858	146	1 74	8382	1808	7	0 81	855
1824	144	4 94	2911	1807	6	0 64	925
1829	140	4 64	3012	1810	6	0 80	744
1850	128	1 82	7006	1784	6	2 11	284
1830	111	3 97	2797	1797	5	0 24	2012
1832	105	3 15	3331	1788	5	0 35	1425
1828	IOI	3 56	2833	1787	5	0 35	1407
1848	91	1 28	7095	1786	5	0 43	1151
1820	75	2 50	2998	1798	5	0 24	2046
1814	66	3 20	2062	<u> </u>	 		

lying-in hospital, that childbed fever can be implanted into a healthy individual by the hospital itself
(p 260) There probably are few rooms in which more puerperae

TABLE LXIV

Year	1 7.			TAB	LE LXI	V				
	Pct	Deat	ths	Births	Yea	ar	Pc	t	Deat	hs B
1842	12 11	730		6024	7-0	,				
1825	8 32			² 594	178		2 1	- 1	6	; ,
1837	8 59	375		-394 4363	185		20		161	7
1834	8 41	355		4218	180		19		41	20
1826	8 12	1 000			181		19		20	1
1846	8 06	567		² 357 7027	1850		I 8	2	128	70
1836	7 98	331			1858		I 74	4	146	83
1854	7 83	610		4144	1821		1 66	5	55	32
1843	7 72	457		7789	1785		I 44	.	13	8
1823	7 45	214		5914	1809		I 42		13	
1831	6 62	222		2872	1848		1 28		-3 91	9.
1840	6 44			3353	1796		I 16		22	700
1841	6 05	328		5166	1813		1 08		21	190
1855	5 63	330		5454	1799		0 96	- 1	20	194
1835	5 61	372		6597	1817		0 91		25	206
1844	5 38	227	1 .	1040	1792		0 89		_	² 73
1833		336	1	5244	1822		0 84		14 26	157
1819	5 25	205		3907	1808		0 81	- 1		306
1839	4 98	154	3	089	1801	- 1	0 80		7	85
1824	4 96	248	4	.992	1810		0 80		17	2106
1852	4 94	144	2	911	1790				6	744
1829	4 76	373	1 7	831	1815		0 75	1	10	1326
1845	4 64	140		012	1806		o 73	1	19	2591
1856	4 63	313	6	756	1803		o 73		13	1875
1830	4 01	281		95	1807	1	0 72 0 64	1	16	2215
1838	3 97	111		797	1812		•	1	6	925
1828	3 92	179		60	1791		63		8	1419
1814	3 56	101		33	1789		57		8	1395
• 1	3 20	66	20		1816		56		7	1246
1832	3 15	105	33	31	1786		49	נ	2	2410
847	2 98	210	70		1805		43		5	1151
849	2 62	190	72		1804		40		9	2112
793	2 61	44	168		1794		39		8	2022
857	2 58	207	801		1802		39		7	1768
851	2 58	196	758		1788		38		9	2346
820	2 50	75	299		1787		35		5	1425
818	2 18	56	256	- 11	1797		35	4	;	1407
827	2 15	51	236		1798	0		5		2012
795	2 11	38	I 79		-190	0 :	24	5		2046

have died than in the sick ward of the First Clinic, yet this room, unoccupied from time to time as a result of the chlorine washings, was used as a lying-in ward without the floor being torn up or

the walls being scraped Only the beds were changed, and still the patients cared for there remained healthy.

A locale can only cause childbed fever when it is so polluted with decomposed matter that the exhalations of decomposed matter mixed with the atmospheric air penetrates into the genital organs of the patients, but a lying-in hospital, polluted to that extent, should not be permitted to exist. In such a classification belong only the dissecting rooms

Fear is not an etiologic factor for childbed fever because it never introduces decomposed matter into the individual from without, nor does a decomposed matter form within the individual. We have already stated that fear did not explain the onset of the mortality in the First Clinic because fear was a result of the mortality already present, for the same reason we were not in the position to relieve the patients of their fear when the state of health began to improve. They had the same fears when they came, yet the cases of childbed fever were not so numerous as before. If fear is an etiologic factor for childbed fever, then this disease should be just as frequent outside the hospital as it is within, because fear affects those confined outside the lying-in hospital as well as those within

Every busy accoucheur knows well that throughout pregnancy not only primiparae but also multiparae are tormented by the fear that they will not survive their coming labor. In almost every textbook on obstetrics one may read that the fear of death towards the end of pregnancy embitters the life of the gravida and she often has the opportunity to fear death in ten or twelve pregnancies, because the tenth or twelfth repetition of this fear does not cause lethal childbed fever

The fact that patients delivered in the Vienna Lying-in Hospital are all unmarried girls, from the poorest classes of society, who, during their pregnancies, must earn their bread by hard work, exposed to misery and want, and under the influence of depressing emotional states, lead immoral dissolute lives, will neither introduce a decomposed matter into their genital organs from without, nor produce a decomposed matter inside them

Such conditions therefore are not etiologic factors for childbed fever.

Aside from the fact that this description does not apply to all those delivered in the lying-in hospital, the mortality outside the hospital, if these conditions cause childbed fever, must indeed be just as great in the hospital, because certainly not all those who are delivered outside are chaste and happy women who spend their days in a life of ease

The injured sense of modesty of the patients who are delivered within the lying-in hospitals in the presence of men is not an etiologic factor for childbed fever, because this injured sense of modesty does not introduce a decomposed matter into the patient from without, nor cause it to form within.

Of a truth, the thoughtlessness with which the etiology of childbed fever has been treated (p 262) is evident, when one again finds a delicate sense of modesty attributed to the patients, previously described as castoffs, and yet in the higher and highest strata of society patients are delivered in the presence of physicians, and do not die from childbed fever as a result of the injury to their modesty, in such numbers as do the previously mentioned population of the lying-in hospital. The overwhelming majority of deliveries take place only with the assistance which a midwife can give, under the present system of training, and fortunately for the mother and child, only in rare cases is the accoucheur needed

It is the custom in many countries to call the accoucheur only to these rare cases. But because the aid which only the accoucheur can render, as a rule must be obtained promptly, if the outcome is to be a happy one, it happens frequently that he is called too late and hence cannot do what he might have done if he were called early enough in the labor

On such experience are based the efforts of the accoucheur to teach the patients in need of such aid that skilled assistance should be present during every labor, so that timely aid may be rendered, should danger appear

But if an injured sense of modesty be an etiologic factor for childbed fever, then necessarily all parturients will be exposed to the danger of childbed fever in order to protect some few from danger.

Male obstetrical assistance must then be forbidden if an injured sense of modesty is an etiologic factor for childbed fever

Conception, pregnancy, hyperinosis, hydremia, plethora, the individuality of the patient, errors in diet, and chilling (p 263) are not etiologic factors of childbed fever, because all these conditions neither introduce a decomposed matter into the patient from without, nor do they cause it to form within the patient

If these conditions are all etiologic factors, then the geographic extension of childbed fever could not be limited to Middle Europe, and the history of the this disease could not document puerperal fever as a disease of modern times

Etiologic factors for childbed fevers are all those things which either introduce a decomposed animal-organic matter from without, or cause it to form within the individual

The factors which introduce a decomposed matter into an individual from without and cause childbed fever thereby are the following:

When the directors of lying-in hospitals and their assistants, for their own instruction and that of their students, occupy themselves in such a manner as to contaminate their hands with decomposed matter, when the director of a surgical department at the same time is head of the obstetrical department, when a gynecological and an obstetrical department are conducted by a single staff, when the students of practical obstetrics attend the pathological and medico-legal autopsies, when they visit the medical and surgical departments, when they take operative courses on the cadaver in surgery and ophthalmology, when they participate in the microscopic courses, in which different decomposed tissues are examined, when they attend courses in pathologic anatomy, when the active assistant gives them instruction in operative obstetrics on the cadaver, when assistants and students perform autopsies, when the directors and assistants in the lyingin hospital treat diseases, which (p 264) produce decomposed matter, when the diseased parturients are delivered with the

healthy ones in a common delivery room; when diseased puerperae are cared for along with healthy ones in a common ward, when such attendants, as the matron, by whom a large number of healthy patients are examined, gives douches to the diseased patients; when many utensils, such as sponges, instruments, bedpans, etc, are used for the sick and the well, when the linen and the bedding does not always present the necessary degree of cleanliness, then the air in the wards can become impregnated with decomposed matter, either because the exhalations of the puerperae are not removed by ventilation, or because decomposed matter is carried into the lying-in wards from the general hospital, from the nearby deadhouse, from the open sewers outside the lying-in hospital, childbed fever is caused outside the lying-in hospital by the fact that the medical personnel of both sexes contaminate their hands with decomposed matter and the necessary cleanliness is not observed in regard to the various articles and utensils used for the care of the patients, etc, etc. These are the etiologic factors to which we could add many more, if it were not superfluous, because it follows from all the things that have been enumerated that in this category belong all of those things which introduce decomposed matter from without, and cause the devastations among the puerperae, which are falsely attributed to atmospheric influences

As for the etiologic factors which cause the formation of a decomposed matter within the individual and thereby cause childbed fever through auto-infection, they are as follows:

Decomposition of the normal lochial flow, as a result of a rather prolonged retention of the lochial discharge (p 265) from whatever cause, retention of the placenta or placental and membranous remnants, retention of blood-clots in the uterine cavity after hemorrhage, bruising of the genital organs as a result of a prolonged stage of expulsion, or as a result of necrosing perineal lacerations after operations

Whether there are many other additional causes of autoinfection, must first be learned from prolonged observation. Up to the present time, my observations on this point have been disturbed by the fact that in the institutions in which they were made it was not possible to exclude all cases of infection from without. The number of cases of auto-infection at any rate must be trifling, because in Vienna in 1797 out of 2012 and in 1798 out of 2046 puerperae, there were only 5 deaths in each of these years, or 1 in 400.

(p 266) PROPHYLAXIS OF CHILDBED FEVER

Since the only cause of childbed fever, i.e. a decomposed animalorganic matter, can either be introduced from without, or can also be formed within the individual, the problem in the prophylaxis of childbed fever consists in preventing the introduction of the decomposed matter from without, in stopping the formation of decomposed matter within the individual, and finally in removing the decomposed matter already present from the organism as soon as possible, in order to prevent its absorption and thereby the outbreak of childbed fever

The carrier, by which the decomposed matter is most frequently introduced into the patient from without, is the examining finger

Since in the case of a large number of students, it is safer not to contaminate the finger than to clean it after contamination, I petitioned all administrative authorities for the proclamation of a law, which would prohibit every person employed in the lying-in hospital for the duration of his stay there from coming in contact with things which might contaminate his hands with decomposed matter

The urgent necessity of such a law was made clear to me by the knowledge that, despite every effort, it was impossible for me to limit the cases of childbed fever in the First Obstetrical Clinic to the cases of auto-infection

(p 267) When one considers that the semester for practical obstetrics does not begin for each student on a single day, when every one could be instructed in his duties, but that the students in this course come and go every day, thus making it impractical to outline their duties to them every day, obviously it would be quite possible that many of them would receive their instructions

only after several days of attendance, when one considers that the forty-two students in the First Clinic spend the greater part of the day in the dead-house at pathological and medico-legal autopsies, in the various departments of the general hospital and in the different operative and other courses, and thus their hands not only become contaminated with decomposed matter, but downright saturated with it, and when it is not improbable that many of these hands so saturated are not exposed sufficiently long to the action of the chloride of lime solution for complete disinfection, when one considers all these particulars, then it must be conceivable that cases of infection from without will always occur in the First Clinic.

These disadvantages can only be avoided by the above-mentioned law, which may have other salutary effects. I shall have occasion later to quote numerous Professors of Obstetrics, who have written against my doctrine, and even their students, who have also inveighed against my teachings. A fool would only believe that such badly instructed students will disinfect their hands as conscientiously as is necessary. And after Death has reaped a rich harvest, the futility of the chlorine washings will be used as a proof of the epidemic origin of the childbed fever

This pernicious conduct, whereby so many human lives are destroyed prematurely not only in the lying-in hospital, but even generations of badly trained physicians are sent out into practice, whose cases of infection will also be used as arguments for epidemic (p 268) childbed fever outside the lying-in hospital, can only be stopped by such a law. If as a result of this law, the students in the lying-in hospital will have clean hands, then the most passionate lecture on the epidemic influences will cause no epidemic, without it, the caution of the students will be lulled to sleep, and childbed fever will thereby be multiplied by hands polluted with decomposed matter. For that reason, we exhort all administrative authorities to proclaim such a law, so that the parturient sex may not be more decimated in the future, and the still unborn child may not be inoculated with the germ of death, and indeed directly by those whose calling it is to protect them

Such a law would not be a hindrance to the training in the other branches of medicine, because only a relatively short time is

devoted to practical obstetrics, and it would actually advance the practical instruction in obstetrics, because the most instructive cases would not occur when the students are otherwise engaged, as frequently happens now

It is, moreover, the custom to precede the practical course in obstetrics with theoritical instruction, and with this theoretical course is combined the operative exercises on the cadaver. During this period the students must also attend the autopsies on the patients who died in the lying-in hospital, so that, before their admission into the lying-in hospital, the students are already familiar with the pathologic anatomy of childbed fever and the obstetrical operations on the cadaver, and therefore have no reason to occupy themselves with such things during their stay in the hospital

Through such a law would the most productive, but not all the sources be abolished, whereby (p 269) the hands may be contaminated by decomposed matter since, even in the lying-in hospital itself, childbed fever can come from auto-infection which, taking the course of endometritis septica, produces material for contaminating the hands. There are also admitted parturients who suffer from diseases productive of decomposed matter

The necessity for disinfecting the hand will therefore always be present, and in order to completely attain this object, it is necessary to oil the hand well before any contact with decomposed matter, so that the decomposed matter may not penetrate into the pores of the skin, after such occupation the hand must be washed with soap, and then exposed to the action of a chemical agent, capable of destroying the decomposed matter not yet removed, we use for this purpose chloride of lime and wash until the hands are slippery

A hand so treated is completely disinfected Carriers of decomposed matter are not only the examining finger, but all objects, contaminated with decomposed matter, which come in contact with the genitalia of the patients, these objects must be disinfected before their contact with the genitalia or must not be used, in this class belong instruments, bed-pans, bed-linen, sponges, etc., etc

Since the atmospheric air can also be a carrier of decomposed

matter, the lying-in hospitals should be built in places where no decomposed matter can be carried into them from without by the atmospheric air, and on that account they should not be a part of large hospitals. The exhalations of the patients must be removed by ventilation from the wards before their putrefaction. An additional necessity in the (p 270) prophylaxis of childbed fever would be, for each lying-in hospital, several separate rooms for the complete isolation, from the healthy patients, of those individuals who give off decomposed matter, or whose disease engenders decomposed matter. Under the supposition of the isolation of the sick patients, the cell-system is no necessity for the prophylaxis of childbed fever, and it is wholly immaterial how many healthy puerperae there are in a ward, if the number is in proper proportion to the size of the room. At the First Clinic we have cared for 32 puerperae at one time in one ward.

Clinic we have cared for 32 puerperae at one time in one ward. Likewise, it is not necessary for the prophylaxis of childbed fever to erect several small lying-in hospitals, instead of one large one. It is, of course, true that the absolute mortality in a small lying-in hospital can never be so great as in a large one, e.g. Kiwisch reports that at the obstetrical clinic in Wurzburg in one year 27 out of 102 puerperae died. The most unfavorable year at the Vienna Lying-in Hospital during the 75 years of its existence was 1842, there died, as you know, in the hospital as a whole, 730 out of 6024 puerperae, or, when we consider only the First Division, 518 out of 3287 puerperae. What an enormous difference in the absolute mortality between the small Wurzburg and the large Vienna Lying-in Hospitals! And yet the relative mortality in the small Wurzburg Lying-in hospital in the world in its most unfavorable year, because in Wurzburg 26 47% died, while in Vienna, taking the lying-in hospital as a whole, 12 11% died, and in the First Division alone, 15 75% It is easy to explain why the relative mortality is greater in the small lying-in hospitals

(p 271) In such hospitals material for instruction is assigned in a frugal manner, and on that account every case is used, and many of the few patients used for instruction are infected if

examined with unclean hands, in Vienna teaching material is available in such a superabundance that hundreds and hundreds of patients are never used for this purpose and therefore are not infected and in this way improve the relative mortality

As for the prophylaxis of auto-infection, so that no decomposed matter may be engendered within the individual, a prolonged stage of expulsion must terminate opportunely by a suitable operation in order to prevent crushing injuries to the genital organs, the operation itself must be done as gently as possible to avoid producing lesions which it was intended to prevent, for this reason, e.g., during a forceps operation, rotating and pendulum movements are reprehensible, because of the contusions to the genital organs which are a necessary result of these movements

The placenta and remnants of the placenta and of the membranes must be removed from the uterus before they become putrescent, injections must be given several hours after the cessation of uterine hemorrhage to remove any retained bloodclots, for they decompose and form thereby the material for auto-infection, if left behind, perineal lacerations should be prevented, because not only is an absorbing surface not formed thereby, but at the same time there will be no matter to be absorbed. If a decomposed matter is actually formed within an individual, this must then be removed by cleanliness and injections, so as to prevent absorption as far as possible

In so far as these same conditions occur outside the lying-in hospital also, this same prophylaxis must be observed, (p 272) and to further the practice of this prophylaxis, in the oath and in the official instructions given to male and female medical personnel at the time of their graduation, it should be required that they swear to follow all that is prescribed for the prophylaxis of child bed fever as scientifically as possible

Whoever observed this prophylaxis will from time to time have the satisfaction of not losing every third or fourth puerperae from childbed fever, but probably only one out of four hundred, and certainly less than one out of one hundred (p. 273) CORRESPONDENCE AND OPINIONS IN THE LITERA-TURE FOR AND AGAINST MY DOCTRINE

If we, in the present essay, were pursuing no other purpose than the firm establishment of our doctrine, and making quite clear the sad error in the doctrine of epidemic childbed fever, if we pursue only this purpose, then we could fittingly close our pages here because we would have no more to add to our teachings, in order to establish them more firmly and we would have no more to say, in order to make evident the untenableness of the doctrine of epidemic childbed fever.

But that alone cannot be the aim of this present work, my doctrine is not intended to moulder in libraries, buried under the dust; its mission is to be beneficently effective in practical life. My doctrine is intended to be propagated among the teachers of medicine, so that the medical personnel, down to the last village surgeon, down to the last village midwife, may so conduct themselves, that terror may be banished from the lying-in hospitals, and the wife may be preserved for her husband, the mother for her children

The birthday of my doctrine occurred in the latter half of May, 1847 If we put the question to ourselves now after twelve years, did my teachings fulfill their mission, then the answer has a melanchloy sound. While it is true that my doctrine may not be as widely discussed as formerly, yet the essence of my teachings has been promulgated, (p. 274), viz, it is a known fact that wounds acquired during autopsies can result in pyemia, and since the findings on cadavers dead from pyemia are identical with those dead from childbed fever, then childbed fever is the same disease, if it is the same disease, then it must have the same cause, this cause undoubtedly is frequently present on the hands of the physician, if through the removal of the cause, the effect disappears, then the fact cannot be doubted

So widely was the matter promulgated from the beginning, that one from the first would believe that, for men of science whose vocation is the saving of human life, such evidence would be sufficient to move them to serious consideration, particularly where it had to do with a disease of which everyone unanimously

speaks only with horror, one would believe, considering the clearness of the matter alone, that it would be self-explanatory and be treated accordingly

Experience has taught us differently, the preponderantly greater number of lecture rooms still echo with discourses on epidemic childbed fever, and with Phillipics against my doctrine; thereby generations of new infectors are continually sent out into medical practice, and it cannot be prophesied when the last village surgeon and the last village midwife will spread infection for the last time

The medical literature of the last twelve years has always been distended with the reports of puerperal-epidemics observed, and in Vienna, the birthplace of my doctrine, 400 puerperae were killed by puerperal fever in 1845, in the published medical works, my teachings are either ignored or attacked, the medical faculty at Wurzburg has awarded a prize to a monograph on the pathology of childbed fever, published in 1859, (p 275) in which my doctrine is condemned. We shall have the opportunity to quote the directors of lying-in hospitals in which my teachings have been followed with success, and yet they attack my doctrine, ascribing the results to other circumstances. Indignation over the magnitude of these scandals has forced the pen into my unwilling hand. I would consider myself a criminal if I should silently leave the extension of my doctrine into practice to time and unbiased trial.

If we look around us for the causes which make men of science so obstinately oppose the truth, men, whose vocation is the saving of human life, yet who persist in a stiff-necked adherence to a teaching which condemns to death the patients committed to their care, and attack him who would teach them how to save these lives, of these we shall find very many. We shall find all those causes which paralyzed the law requested by me not mentioned once, because an enumeration of them in the absence of this law would certainly not produce any results, but on the contrary would only incite violent emotional upsets with this law, the results of these causes would dwindle, even without having to enumerate them

There are however two causes, obstacles to the practical extension of my doctrine, which we shall name, because we are in a position to act against them.

One is the habit of my opponents, in their attacks, of continually appealing to their adversaries to bear witness to their pure love for the truth, even Carl Braun goes so far in his renunciation of the truth, as to say in his *Textbook of obstetrics*, p 921. "In Germany, France and England, this hypothesis of cadaveric infection has been condemned almost unanimously up to this day!"

Not everybody is familiar with the literature in its full extent, (p 276) might not a few, who are familiar with it, be provoked by such utterances to consider this matter fully, and to adhere to it? Certainly not

Although the proverb "propria laus sordet" is well known to us, nevertheless we shall collect here all the favorable comments on my doctrine, so as to render ineffective the consequences of my opponent's silence We much prefer to avoid the reproach of self-praise, as we are convinced that we may thereby bring many people to the point of earnest, unbiased meditation and thus convert them The second cause which is a hindrance to the practical extension of my doctrine, is found in the numerous objections which have been raised, I admit that it is conceivable that these objections may make a forceful impression on many individuals, and it requires enthusiasms for the affair, such as I possess, and familiarity with it, such as I have, in order to find the hidden error which is represented as truth. We shall assemble here everything that has been said in our favor, and even more conscientiously, everything that has been said against us, with the appropriate answers, although we are aware that this will invite the hatred of many colleagues We shall find comfort in the conviction that our reply is not the object in itself, but only a not too evasive means for bringing the truth to God knows how many physicians who are kept in error, to the detriment of mankind, by the siren-songs of my adversaries

We shall no collect tha praise and also the censure, which we have harvested, in chronological order as far as is possible

The first publication of my doctrine was made by the editorial staff of the "Zeitschrift der k k Gesellschaft der Aerzte zu Wien," Dr Ferdinand Hebra, Editor, with the two following articles Highly important findings on the etiology of epidemic childbed fever in lying-in hospitals

"The editorial staff of this journal feels obliged to communicate herewith to the medical public the following observations, made by Dr Semmelweis, Assistant in the First Obstetrical Clinic of the local Imperial and Royal General Hospital, on the etiology of the puerperal fever prevalent in almost all lying-in hospitals

"Dr Semmelweis, who has already served over five years in the Imperial and Royal Hospital, has thoroughly grounded himself, at the autopsy table as well as at the bedside, in the different branches of the healing art, and in short during the last two years has devoted his special activities to Obstetrics, has set up for himself the task of searching after the cause which underlies the so devastating and epidemically current puerperal fever. In this particular field nothing has been allowed to go untried, and everything which might exert a harmful influence, was carefully isolated

"Through the daily visit to the local pathologic-anatomic institute, Dr Semmelweis has learned to recognize the harmful influence which was carried by ichorous and putrid humors on uninjured corporeal members of the personnel, occupied with the dissection of cadavers. This observation aroused in him the idea, that perhaps in lying-in hospitals the fearful puerperal process might be inoculated into the gravidae and parturients by the accoucheurs themselves, and that in most cases it was none other than a cadaveric infection

"In order to test this view, the regulation was made that, in the labor room of the First Clinic, everyone who wished to examine a gravida must first wash his hands in a watery solution of chloride of lime (p 278) (Chloratis calcis unc 1, Aquae fontanae lib duas) The result was surprisingly favorable, while in April and May, when this rule was not yet put in practice, 18

^{*}Zeitschrift der k k Gesellschaft der Aerzte zu Wien, 1848 Year 4, v 2, p 2,2 and year 5, v 1, p 64

deaths occurred for each 100 births, the number of deaths in proportion to the births in the following months up to November 26, inclusive, was as 47 to 1547, 1e there died 245 out of 100.

"By this fact was probably solved the question why such a favorably mortality ratio prevailed in the school for midwives in contrast with that in the divisions for accoucheurs, with the exception of the Maternité in Paris, where—as is well known—the autopsies are done by midwives

"Three particular findings may further confirm the conviction just stated, they even may extend its scope Dr Semmelweis believes that he can prove that

I through the negligent washing of some students, working in Anatomy, in September, several victims perished.

- 2 in the month of October, through the frequent examination of a parturient, suffering from a discharging medullary carcinoma of the uterus, after which the washings were not observed as well as finally
- 3 through an ulcer with an ichorous discharge present on the leg of a puerpera, several of the parturients delivered along with her were infected

"Thus the transfer of an ichorous exudate from living organisms

can be the exciting cause for the puerperal process

"Since we have published these findings, we request the directors of all lying-in hospitals, a few of which have already been informed of these highly important observations by Dr. Semmelweis himself, (p 279) that they contribute their observations for confirmation or refutation!"

The second article reads

Continuation of the findings on the etiology of puerperal fever,

epidemic in lying-in hospitals

"In the December, 1847, issue of this journal, on the part of the editorial staff, were published the highly important findings which had been made by Dr Semmelweis, Assistant in the First Obstetrical Clinic, in reference to the etiology of puerperal fever, at present epidemic in lying-in hospitals

"This finding (as the reader of our periodical will recall) was

that puerperae principally became ill when they were examined (touched) by physicians whose hands had been polluted during their investigations on cadavers and washed afterwards only in the usual manner, while either none, or only a few cases of the disease occurred, if the examiner had previously washed his hands in a watery solution of chloride of lime

"This highly important discovery, worthy of being ranked with Jenner's cowpox-vaccination, has not only attained complete corroboration in the local lying-in hospital since then," but approving voices have also been raised abroad which have confirmed the correctness of Semmelweis' theory Letters received, particularly from Michaelis of Kiel and Tilanus of Amsterdam, are the sources from which I have taken the corroborating information

"In order that this discovery may attain its full validity, all directors of obstetrical institutions are hereby most kindly requested to undertake tests, and then to send the corroborative or negative results to the editorial office of this journal!"

Dr Carl Haller, at that time Chief Physician and Provisional Director, in his medical report from the Imperial and Royal General Hospital in Vienna and the institutions connected with it (the Imperial and Royal Lying-in, Psychiatric and Foundling Hospital), after having given his report of the two divisions for the solar year 1848," says the following †

"The mortality rate in the two large free divisions of the lyingin hospital is almost the same, and must be called satisfactory from every view-point

"For years there has been however a serious difference The First Obstetrical Clinic, under the direction of Professor Klein, and to which all male students are exclusively assigned, had a

† Zeitschrift der k k Gesellschaft der Aerzte zu Wien Year 5, v 2, p 536

^{*}In as much as in the month of December 1847, of 273 puerperae, 8 died, in January 1848, of 283, 10 died, in February, of 291, 2 died and in March, no deaths occurred, even at the present time not a single case of puerperal fever is in the hospital. During the ten months in which wishing with calcium hypochlorite was critied out before every examination, only 67 deaths have occurred from 2670 maternity cases, a number which previously would have been exceeded in a month

shockingly large mortality, compared with that of Professor Bartsch's school, where all midwives receive their instruction

"The reasons for this highly disturbing phenomenon was never established with certainty The great ment for their discovery belongs to the Emeritus Assistant of the First Obstetrical Clinic, Dr Semmelweis Actuated by the suspicion that that the numerous cases of illness and deaths among the puerperae could probably be attributed for the most part to the introduction of a cadaveric poison during vaginal examinations by students and obstetricians, also busy in the dissecting room, (p. 281) and that this transfer of cadaveric poison was not prevented with complete certainty by the then customary washing with soapy water, in May 1847, with the consent of Professor Klein, he caused every physician and student in the clinic to wash their hands carefully with chloride of lime solution before every inital examination of a parturient or puerpera, and this washing was repeated after every examination of a puerperae ill even to the slightest degree The consequent performance of this measure had surprising results, even in the first month

The number of deaths decreased promptly in 1847 with almost the same number of births to 283, and sank from 11 4% to 5 04% in the course of the year 1848, but when these washings were carried out persistently and methodically throughout all the months of the year, the mortality rate equalled that of the Second Obstetrical Clinic, it was perhaps even still about 0.1% more favorable

Since the decreased invalidism and mortality among the mothers was also a life-saving measure for the newborn, their mortality decreased to a remarkable extent *

Convincing proof for the correctness of these conclusions can be obtained by the reader from a comparative glance at the following tables, in which the births and deaths of the three divisions of the lying-in hospital for the last ten years are arranged together, and in addition, it must be noted that the mortality rate is only approximately correct, since during the prevalence

^{*} The mortality of the new born was reduced because they no longer received a mixture of blood from the mothers

of puerperal epidemics at the First Obstetrical Clinic for sanitary and humane considerations, a not inconsiderable number of sick puerperae were transferred from the lying-in hospital to (p 282) different divisions of the general hospital and are omitted from these records as dying there "

Now follows the table, which in this book is the same as No. I, p 3. Haller says further. "And what is imperatively impressed upon the unprejudiced examiner of these figures, has been established beyond all doubt by direct experiments on animals (injections of pus and ichor into the vaginae of newly delivered rabbits), which were done by Drs Semmelweis and Lautner recently, and after complete analysis, will be published

The significance of this practical knowledge for the obstetrical institution, for hospitals in general and especially for the surgical wards is so immeasurable that it appears worthy of the most earnest consideration of all men of science, and is certain of suitable acknowledgement by the high state-government."

Although the editorial staff of the "Zeitschrift der Gessellschaft der Aerzte", at the close of both articles, invited the directors of the lying-in hospitals to contribute their share in confirming or refuting my doctrine, I did not consider it superfluous to get in touch with the directors of the lying-in hospitals personally and therefore many letters were written to these men, either by myself or through my friends Several of these letters were not answered The first answer came, and as the saying is, unbelievably quickly by return post, from Simpson of Edinburgh Dr Arneth, my friend and colleague from the Second Division, and more fluent in English than I, had written Simpson, and I regret that I cannot reproduce the letter here, because, according to Arneth's oral assurance, it has been lost during the course of the many years which have passed since then however, was filled with abuse, Simpson said (p 283) that he was aware, even without the letter, of the deplorable condition obstetrics was in in Germany and particularly in Vienna, he knew positively that the cause of the great mortality lay only in the unlimited neglect to which the puerperae were exposed, e g

healthy puerperae were put in beds where others had just died, without even changing the bed-clothes

Our letter was also evidence that the English literature was entirely unknown to us, because if we were familiar with the English literature, we would know that the English have long considered childbed fever as a contagious disease, and have used chlorine washings for its prevention

Because of this letter, we felt it would be better not to continue the correspondence with Prof Simpson but we refer our reader to page 193 of this work, where we have set forth at length the essential differences between the opinions of the English physicians and ours

That Simpson should rashly consider my views on the origin of childbed fever as identical with those of the English physicians, is evident from some correspondence which I had with Dr F H. C Routh of London

Dr Routh attended the First Obstetrical Clinic as a student during my assistancy, and what he saw there convinced him of the correctness of my views. He returned to his own country, resolved to spread my teachings there. I received the first letter, dated January 23, 1849, London, with the following contents.

"In the assembly of English physicians which took place the last week in November (1848), I delivered a lecture in which I announced your discovery, securing the extreme honor rightly due you. I can say that my address was well received and that many of the most learned members declared that (p. 284) the arguments were convincing. Among these there were, in particular, Webster, Copeland and Murphy, all famous physicians, who spoke extremely well of you. In the November issue of the Lancet, all of this discussion can be read

"Do you think that the cases which occurred after my departure also support your opinions? Is childbed fever less common than before?

"If this dangerous disease occurs less frequently in the obstetrical wards than formerly, then this most significant success is established In Prague also, where childbed fever is so common, it is attributed to the same exciting cause"

"Dorset-Square, London, May 21, 1849

"My notes on your discovery have been published in a brochure"*

"Dorset-Square, London, December 3, 1849

"The reputation and the truth of your discovery are ever growing in the general esteem, and all medical societies recognize and appreciate how useful it is, and this does not appear to be a rash statement, for great is Truth and it shall prevail"

Murphy, formerly Professor of Obstetrics and now of London, published a rather long article in the Dublin Quarterly Journal of Medical Science, in which he discusses the above-mentioned lecture by Routh, and agreed with the views expressed therein †

Simpson himself has abandoned the opinion that childbed fever is a contagious disease ‡

He now considers childbed fever to be identical with surgical fever, and says "In childbed fever and in surgical fever, the fever is not the cause of the accompanying inflammations, but the fever as well as the inflammations are the result of a common cause, namely the original corruption of the blood. But what causes the corruption of the blood must be answered in a later era with a more developed pathologic anatomy, histology and chemistry"

This problem is already solved, the cause of the blood-corruption and of the accompanying fever and inflammations in childbed fever (p 286) and surgical fever is an absorbed decomposed animal-organic matter

The second answer came from Professor Michaelis of Kiel Dr Schwarz, Michaelis' pupil, was in the practical obstetrics

^{*}On the causes of the endemic puerperal fever of Vienna By C H F Routh, M D, London, 1849 Reprinted from the Medico-Chirurgical Transactions, Vol 32

[†]Reprint What is puerperal fever? A question proposed to the Epidemiological Society, London, by Edward William Murphy, AM, MD, 1857

[‡] Edinburgh Monthly Journal, November, 1850

course in the First Obstetrical Clinic at the end of the year 1847, and wrote to Michaelis the observations he made there, and in return as answer the following letter arrived

"Dr Hermann Schwarz, Vienna

"Your letter of December 21, 1847 has aroused my greatest interest. I am again in the greatest distress. Our institution was closed as the result of puerperal fever from July 1 to Novem-The first three cases admitted then became ill, one died and two were scarcely saved. We were already about to close the hospital again. Meanwhile, health conditions again improved, two of the early sick patients easily recoverd, only one died in February, Since then all have remained well. Your letter at first gave some courage again, the evidence of the virtues of the chlorine washings, in so far as they were carried out in Vienna, is significant because of the large numbers I introduced this procedure into the institution immediately, and since then, neither candidates nor midwives may examine without washing with the chlorine water It has already been used by a midwife in the city who delivered several women, who later suffered from puerperal fever.

"I have sent an abstract of your letter to Copenhagen From my own limited experience, it would be presumptuous to condemn the great Vienna experiment

"Nevertheless, I cannot forbear to tell you of some things, whose connection with this matter, though slight, could easily be overlooked

(p 287) "Since last summer, when my cousin died of puerperal fever, whom I had examined after her labor, subsequent to an autopsy I had done on a diseased puerpera (now follows a long, unreadable word), I have been convinced of the communicability of the disease. I remembered then that I had been called by Dr Freund to see a patient in the city, who had likewise died of puerperal fever Consequently, I refused to attend any deliveries for four weeks A parturient, whom I should have attended, for that reason was compelled to call another physician, there was a prolapse of the umbilical cord, he replaced it, he had done many autopsies, and was accustomed to dissect every day, the

patient became ill of puerperal fever and recovered, but had a mass of exudate alongside the uterus. The midwife, who assisted in this case, had at least two, probably three cases of puerperal fever in the city. So much for the propagation of the fever.

"As far as the security through the chlorine washings, I can recommend it as very effective, because the odor which clings to the hands all day long in spite of repeated washings, is readily removed by the chlorine water. Since the introduction of these washings there has not been the slightest degree of fever among the cases delivered by me or my pupils any more, with the exception of one case in February, on whom, as I suspect, a badly cleaned catheter was used, and she was isolated. After the bad beginning in November, I expected the worst sort of an epidemic However, my experience is limited to about 30 cases, since we accepted only a few cases. I thank you with all my heart for your information, it has perhaps already saved our institution from ruin, to erect a new hospital in these times would probably be impossible. I beg you to commend me to Dr. Semmelweis, and also to thank him, because I believe he has made a great discovery

"You know that puerperal fever has appeared among us (p 288) only since 1834. This is also about the time when I began to take an active part in the teaching, and the vaginal examinations on the part of the candidates became the rule Even these things may have some connection"

Kiel, March 18, 1848"

Our views on the origin of childbed fever have been brilliantly proved in the Kiel Lying-in Hospital, there is no need to stress the small size of the hospital, because if it was large enough to be closed on account of a puerperal fever epidemic, then it is also large enough to serve as a proof of the absence of the epidemic

Another pupil of Michaelis came to Vienna, and when we inquired about Michaelis, we learned to our horror that Michaelis was numbered among the dead. The experiences which he had had, convinced him all the more that he was to blame for the death of his cousin, of which he spoke in his letter, and overcome

by melancholy, he allowed himself to be crushed by a fast train at Hamburg I have related here the unhappy end of Michaelis, in order to place here a memorial to his conscientiousness. our sorrow we shall have the opportunity to present to the reader some obstetricians, for whom one might wish some of the conscientiousness of which Michaelis had so much

Peace to his ashes!!

After I had resolved to appear once again before the public, I thought it would be suitable to ask Professor Litzmann, Michaelis' successor, by letter, what observations he had made at the institution where Michaelis' experiences had corroborated mine. I received the following answer

(p 289)
"On my return from a trip, I came upon your letter, and hasten to answer it as soon as possible During the ten years in which I have been director of the local lying-in hospital, I have sought every opportunity possible to avoid infection of the puerperae by cadaveric poison, along with my assistants I have refrained from every direct participation in the autopsies, and have had the students observe all known precautionaly measures I have indeed been more fortunate in regard to puerperal fever than

my predecessor and have few victims to deplore

"The main reason for this fortunate situation is to be found, however, I believe, in the foresight with which I have endeavored to prevent every overcrowding of the institution with puerperae It contains eight, or actually only seven, rooms for puerperae As a rule, each puerpera for the first 5-7 days has a room for herself, which served her also as a delivery room, and in the second week of the puerperium two puerperae are placed in a room Experience has shown that if the number of puerperae goes over ten for some time, so that in the first days of the puerperium two puerperae must be put in a room together, and the room is immediately occupied again without sufficient airing, childbed fever appears immediately I have therefore sought to so far limit the admissions that, especially in the winter months, the number of puerperae does not go over ten for a long time, and in case

of necessity I have moved the puerperae to private rooms, which I have rented near the institute, to spend their puerperium there I always have recourse to the latter measure, when cases of puerperal fever appear in the institution. This precaution Michaelis never observed. The number of births occurring annually (p 290) amounted to 160–190 under his direction, while I never allow them to go over 150. To be sure, in spite of all precautions, I have not been spared rather small epidemics or endemics, and I have also been compelled to close the institution twice temporarily. The parturients removed to the private homes at the time of such epidemics have remained entirely healthy during the puerperium, or at the most, become ill to a slight degree, with the exception of one case which ended fatally from childbed fever. I will remark, however, that sometimes childbed fever appeared first in the city or in the environs, and thereafter appeared in the institution, or even it was entirely spared."

Prof Litzmann in this letter vouches for the observation of precautions against infection He vouches also for a favorable state of health among the puerperae, but he believes that this should be attributed to the fact that he took precautions against overcrowding of the lying-in hospital We do not share this opinion, since we believe that, without the measures against infection, the prevention of overcrowding would remain ineffective When Michaelis, after the hospital had been closed for four months, opened it again, the three women admitted became ill, although the lying-in hospital was certainly ventilated, and with three patients was certainly not overcrowded. Litzmann lays great stress on caring for only 150 puerperae annually, while Michaelis cared for 160–190 of them, Kiwisch took care of 102 puerperae in a year, and 26 47% of them died, in Vienna, 3086 puerperae were cared for in 1822, of whom 0 84% died Litzmann will have only one puerpera in a room During the time I supervised the chlorine washings, (p 291) in two months we had no deaths The five most unfavorable months before the use of the chlorine washings were those when the number of puerperae was least Consequently the lying-in hospital was less overcrowded than in the two months in which we had no deaths.

We have shown by numerous tables what significance the overcrowding had

For this reason, we believe that we can rightly make the assertion that the favorable state of health among the puerperae in the Kiel Lying-in Hospital for ten years may be ascribed to the measures taken against infection

Michaelis said in his letter that he had sent a copy of Dr Schwarz' letter to Copenhagen, so I requested Prof Levy by letter to inform me of the observations he had made in the past ten years, and received the following answer

"Copenhagen, May 31, 1858.

"Your estimable letter, in which you most kindly invite me to present my experiences in connection with your views on the origin and prevention of puerperal fever, as an answer to a letter of yours transmitted to me ten years ago by the late Prof Michaelis of Kiel, I have certainly had the honor to receive, and I count upon your kindly indulgence, if some weeks have passed before the answer to it could be given

"But before I go into the question proposed to me, allow me to explain my silence on this subject up to now. Shortly after I received, through Professor Michaelis, your interesting letter, I published a Danish translation of it in our "Hospital Reports" of that period, a journal on which I took an active part as Associate Editor, together with some critical comments, and to which, as also to my answer, I referred Professor Michaelis No doubt he had the intention of forwarding you a translation of my remarks, (p 292) and I confess that I had hoped that this had been done before his death. Since I now know differently, allow me, for my own justification and as an addition to these lines, to present you with a translation of my comments of that time, from which arose my uncertainty and hesitation, as they forced themselves upon me, and which still persist in part

"My own experiences in regard to local conditions could only have been of a limited kind. The students, who were then obliged to complete a half-year clinical course in our institute, are

no longer students, but already licensed physicians, who in the course of the first year after having passed the necessary official examinations, are admitted to the clinic of the institute sequently, these men have no more to do with anatomical dissections, and those among them, who at the same time are doing the candidate's service in the other hospitals, are, during the obstetrıcal course, prevented moreover from takıng any active part in the autopsies in the hospitals In the lying-in hospital itself, as emphasized in my remarks, for more than ten years no puerperal cadaver has been autopsied as a rule by physicians or clinicians of the institute, but outside assistance is called in for this purpose Only in a few exceptional cases, where the cause of death is not a puerperal one, do we do the post-mortem examinations ourselves, yet with the precaution that the obducent will only reluctantly participate in the examination of the parturients on the same day. In another direction, however, we have had ample opportunity to accumulate experience, in that all infant cadavers from the lying-in hospital, as well as from the foundling hospital are autopsied here

"Such autopsies occur 3-4 times weekly, and almost all are done by the "reserve" physician of the institute, without any other precautions than the usual regard for cleanliness. Although the same man may frequently take (p 293) part in the examination of the parturients and the operative deliveries, we have never found the least cause for suspecting the autopsies. Chlorine washings are used here in the course of the year, only in the most exceptional cases, where there has been contact with putrid and foul-smelling preparations

"While I send you, my most honored colleague, the following pages, may you not forget that the content is a journal article more than ten years old, which concerns the scientific question only, and has no personal reference. Kindly consider further that the author is a Dane, and therefore may be entitled to some indulgence and possible correction of his style. If these pages should be published, which I gladly allow, my remarks and observations are to placed at the beginning, in so far as they are worthy of publication at all

The Royal Lying-in Hospital in Copenhagen, May 31, 1858"

To this letter I have the following to add Chlorine washings are of course superfluous, if one keeps his hands clean Autopsies on infant cadavers are less dangerous, because they are done sooner after death than in adults, and on that account the requisite degree of putrefaction has not yet set in

"Hospital Reports, Vol. I, 1848, pp 204-211

"I. With all respect for and recognition of the meritorious effort which is manifested in the researches of Dr Semmelweis, I believe that I should give expression to the opinions and the doubts stirred up in me by his views, and which I feel are invited by the letter sent me for publication.

"Above all, it is to be regretted that neither the observations themselves, nor the opinions based thereon, stand out with the clarity and precision which might be expected in so important an etiologic matter Although (p 294) it appears to follow as well from the a priori hypothesis as from the added facts themselves, that the presumed cadaveric infection can, according to the assumption, occur and has occurred without consideration as to whether the infectious material comes from puerperal or other cadavers, so a strict examination would absolutely require that this difference in the source of the infection not alone be taken into consideration, but a discrimination in making the observations would underlie it From a scientific standpoint, and particularly for the question of the contagiousness of puerperal fever of course, it is of great importance to know whether the presumed cadaveric infection is to be considered cadaveric puerperal material merely, or all cadaveric effluvia in general, and in any case, whether the puereral diseases caused by cadaveric infection manifest themselves under identical or different forms, according to the difference in the sources of cadaveric infection. Of course it would be obvious that, as only puerperal cadavers are under discussion, the question is indeed confined to the field, even to the most extreme limits, of contagiousness, because it deals with the products or the residuum of a particular disease,

through transmission by a person particularly disposed to this On the other hand, in the cases where the infecsame disease tious matter may originate in any sort of a cadaver, every idea of a specific contagium must be abandoned, and in place of this, the infection of the blood-mass, in so far as such a thing occurs, must be classed along with the blood infection brought about by the direct introduction of putrid animal matter into the organism by many experiments on animals That hereby a condition can be produced, which has many resemblances to puerperal pyemia, is not to be doubted, but not less firmly stands the knowledge that puerperal fever manifests itself under many other forms, (p 295) and certainly therefore it would be desirable that the examination pass lightly over with lesser indifference the question about the different sources, nature and effect of cadaveric infectious matter"

On the first point, we can answer the following. We have neither written the letter ourselves, nor read it before its transmittal, but we think that it could not have been very obscure, because Michaelis had completely oriented himself

Every cadaver, no matter what disease caused death, is capable of engendering childbed-fever, which therefore is not a contagious disease, but a pyemia, such as experimenters have produced in animals, and although it is certain that puerperal fever also manifests itself under several other forms, yet it is also certain that these cases originate in the same manner as do the cases of pyemia The puerperal fever forms, which are especially desig nated as pyemia, are rarer than the cases which appear under At the First Obstetrical Clinic, the mortality fluctuated (See Table No 1, p 3) between 237 and 518 deaths during six years, in 1848 the mortality was forced down to 45 deaths by the chlorine washings, the 192 and 473 cases over and above the 45 were certainly not all limited to the form called pyemia, but appeared in many other forms, and indeed were also prevented by the chlorine washings, a proof that they had Why the decomposed, absorbed matter caused a common origin pyemia at one time, and the other forms at others we do not know.

Perhaps the reason lies in the different degrees of putrefac-

tions of the decomposed matter, perhaps in the different reactive susceptibilities of the organims

When Prof Levy says further that puerperal fever (p 296) appears sometimes under the form called pyemia, and sometimes under other forms, so that it would be desirable that the examination pass over with less indifference the question of the different sources, nature and effect of the cadaveric infectious matter, if this means nother less than to require that direct experiments be made on human beings, in order to be able to answer all these questions, we would rather know less and keep our puerperae healthy

And if the reproach of indifference must be made, my colleagues deserve it, not I, for certainly every one of them has observed one or more facts, which do not harmonize with the doctrine of epidemic childbed fever and in spite of this, they cling to this doctrine from indifference, instead of reflecting on how to solve the contradiction

"II. The quantitative limits of a specific contagium are incalculable, it is possible that a single atom alone, under favorable conditions for the propagation of the disease process, would be sufficient, certainly, on the question of contagiousness, scarcely any possibility cannot be denied a priori a certain degree of Had Dr Semmelweis therefore, from the standqualification point of contagiousness, limited his views on cadaveric infection to puerperal cadavers alone, I would have felt less inclination for denial, since I myself, while not a contagionist, but only from a scrupulous consideration of contagious possibility, have seen to it that no physician of this institution, when he had participated in the post-mortem examination of a puerperal cadaver, should come in contact with any parturient on the same day. The observation may follow at once, that in this connection I have in mind the transfer of a palpable infection material, (p. 297) rather than the possible effect of a cadaveric effluvium from the hands, hair and clothing.—But, as already remarked, the specific contagium seems to Dr Semmelweis to be of lesser significance, even if it is so little considered on his part, that in his writings there is no mention of the direct transmission of the disease from

the sick to the nearby healthy puerperae To him there is enough in the general cadaveric infection without taking into consideration the lethal disease And in such a conception, I admit, his views do not seem to me to gain probability for themselves For aside from the undoubtedly somewhat exaggerated representation of the capability for absorption of the healthy uterine cervix, which is scarcely corroborated by the direct application of drugs to the same, yet in the experimental introduction of putrid matter into the organism everything seems to prove that the effects produced thereby are dependent on the rapidity as well as on the quantitative proportions, and that the rapidly fatal putrid infection in particular, even through direct introduction of putrid matter into the blood-mass, is necessary rather than homeopathic doses of the poisonous material Out of respect for the sense of cleanliness of the Vienna students, one cannot place a much higher value on the infectious matter hidden in the nailfolds, or on the effluvia from the fingers used for examination of the parturients shortly after anatomical work"

To this second point, we have to reply that we do not consider childbed fever a contagious disease, that moreover we have proven a general infection by means of a decomposed matter, and this decomposed matter can well come also from cadavers.

The attentive reader can answer this himself, I shall only remark that, if childbed fever be a contagious disease, (p 298) the measures taken against the spread of the disease must be carried out preferably in the lying-in wards, because the patients in the labor rooms are as a rule still healthy, and first become ill in the lying-in wards, but we have applied these measure preferably in the labor rooms, with what success is well-known, although we cannot possibly destroy in the labor rooms the contagium, which can only be produced by the patients who fall sick in the lying-in wards later on

We also maintain that the healthy uterine cervix is not capable of absorption, under normal conditions, the place where absorption occurs is the internal surface of the uterus, denuded of mucous membrane as the result of pregnancy

In order to determine the material quantum of decomposed

matter necessary to engender childbed fever, direct experiments should be made, we prefer to remain in ignorance on this point, and are satisfied with the knowledge that whatever remains on the hands after the usual sort of washing, if even perhaps only in the form of a putrid gas, is sufficient to cause childbed fever. That this is true, we can prove by the fact that we have done nothing but destroy only the decomposed matter remaining on the hands after the usual sort of washing, and thus have reduced the mortality of the First Division to 45 deaths in 1848, which during 6 years varied between 237 and 518 deaths

during 6 years varied between 237 and 518 deaths

"III In order to test his already fixed opinion, Dr Semmelweis naturally prescribed the chlorine washings with the intention of destroying every trace of cadaveric residue on the fingers. But would not the experiment be much simpler and more trustworthy, if there had been an agreement, at least for the duration of the experiment, to refrain from all anatomico-pathologic work, to which even the students could reasonably be obligated (p. 299) during the 2–3 months course in the lying-in hospital. In our lying-in hospital, without having any experiment in view, but only from a scrupulous regard for the contagious possibilities, for more than a year we have already gone so far by way of regulation, that no physician, midwife or nurse in the institution comes in close contact with an autopsied puerperal cadaver, and without knowing what part these precautionary methods in particular among several others may have played in the improved state of health, I am of the opinion that it may be continued, so that we must count upon the benevolent assistance of our outside colleagues for our autopsies"

To this we have to replay, that it appears to us also more practical not to contaminate the hands, than to cleanse them again Upon this conviction is based, of course, the petition of the previously mentioned law, which we addressed to all administrative authorities. But in the subordinate position of an Assistant, in which I was at that time, I could not come forward as a lawgiver, and that an appeal, at that time to the higher-ups, would have remained unsuccessful, the reader can understand from the fact, that even the commission of the Vienna professorial college,

which was appointed for such a purpose did not dare to take up their activities And when Professor Levy says that he does not know what part these precautionary methods among several others had in the improved state of health, we can cite for him, as a standard for judgement, the part which these precautionary methods had by themselves alone in the improvement of the state of health at the Vienna Lying-in Hospital, through this means alone the mortality was reduced to 45 deaths out of 3556 puerperae in 1848, while without them, the mortality out of a similar number of puerperae in the course of six years varied between 237 and 518 deaths (p 300) And yet we were using them in a more incomplete form than did Prof Levy, while they did not leave the hands contaminated, but we could not help it, for the reason that so many students had been entrusted to us for the disinfection In another place in this book we have already shown in detail that therein lay the reason why we did not have still fewer deaths

"IV Nevertheless, it will be said, that the results of the experiment seem, in spite of all doubts to the contrary, to corrobo-"Seem" remains the anrate the opinion of Dr Semmelweis swer, but not any more, of course, any one, who over a long period of years has had the opportunity to observe the periodic rise and fall of disease in the lying-in hospitals, doubtless will admit, that essential information is lacking to enable us to evaluate the results obtained, 1 e whether in previous years the institution did not have quite as favorable periods as in the last seven months, for which an exact statistical report on the monthly cases of disease and death would be necessary This deficiency remains even more noticeable, when one recalls that scarcely three years ago Prof Klein in the medical yearbook of the Imperial and Royal Austrian States, January, 1845, published an official report on the operation of the obstetrical clinic for the seven years 1836-1845, according to which the mortality rate 1 15, although sad enough, yet appears 100% better than the mortality ratio with which the results of the period of chlorine washings was It is possible, even more than probable, that recently compared this difference proceeds less from a constantly better state of health, than from single especially favorable periods, but even for this reason it would be conceivable, in the case of more exact statistical reports, that even the results of the last seven months, in part at least (p 301), could occur occasionally by chance, and in part be dependent upon the strict consideration of the cleanliness in general brought about by the experiment "

Time has refuted this point, for now it is no more a question of seven months, but of more than twelve years Professor Levy made demands on the letter of a student, that should only be required of a complete monograph

I believe that the attentive reader of this essay will find the solution of all the doubts which the Professor has raised, particularly since he does not now have to complain of the lack of exact statistical reports. We can assure Professor Levy, that the cleanliness in general at the First Obstetrical was practised to an extent, before the introduction of the chlorine washings, as was not possible in a higher degree afterwards. The particular purpose of the chlorine washings was only the cleansing of the hands, and if the Professor believes that through cleanliness, childbed fever would be prevented, then he is stating what we wished to have recognized through this essay, with this work we wish to spread the conviction that the antithesis of cleanliness produces in women what has been previously attributed to epidemic influences

"V When the results of the experiment for a period, as in September and October, have not come up to expectations, Dr. Semmelweis thinks he can prove the cause was partly due to the negligence of the students in the use of the chlorine washings, and partly to the infection of the parturients by the discharging ulcers of still living organisms, in one case particularly of a medullary carcinoma of the uterus, in another of a puerpera suffering from a discharging ulcer of the shin-bone, so that his original theory has not only been confirmed, but has an enormously wider scope, (p 302) since all sorts of ichorous discharge from still living organisms will be included thereunder. But it cannot be denied that the information on this point has been all to hastily outlined for a critic to establish a couclusion from them. In

particular, it must be important to know whether the puerpera with the medullary carcinoma of the uterus was perhaps made ill with puerperal fever at the same time by the ichorous ulcers of the shin-bone, because in such cases the puerperal contagium would be opposed by the specific contagium of the presumed ichorous infection. In such an opposed case, the first-named patient would obviously be very incompatible from the viewpoint of the contagionists, while in the second it is still impossible to explain if there might have been any closer relation between the ichorous ulcers and the vaginal exploration of the other parturients than with the vaginal examination of the patient herself

"I can add that we in the local lying-in hospital have quite frequently seen chronic ichorous foot-ulcers among the parturients, without having observed any infectious results, either in the patients themselves or in other parturients. And if Dr Semmelweis lays great stress upon the much more favorable state of health, according to his opinion, in the division for midwives, than in the division for the training of physicians, then let him bear in mind, that the ichorous discharges from living organisms can present themselves in equal quantities in both divisions, and that, if the infections take place so easily, as he seems to assume, in such a large institution as the division for midwives, at one time or another, one or another sick patient may frequently be found who would be adequate as sources of infection, so as to diminish or wholly equalize the remaining very remarkable difference in the health conditions of both divisions of the Vienna Lying-in Hospital"

(p 303) The two diseased parturients did not suffer from puerperal fever, for the one with discharging medullary carcinoma of the uterus died of the cancer, and the other with carious ulcer was released after her puerperium was over

For the solution of the remaining doubts about these two cases, the reader will refer to pages 58, 59 and 60 of this work, beginning with line 32 of page 58

The reader will recall that we have assumed that there are three sources from which the decomposed matter which causes puerperal fever is derived, i.e. every cadaver, every diseased person who engenders a decomposed matter, and all animalorganic structures which have undergone decomposition

In lying-in hospitals used for the training of physicians, the decomposed matter is derived from the cadaver, from the diseased patients present in the lying-in hospital, and if cleanliness is not observed, physiologic products such as blood, can undergo decomposition on the bed-linen and thereby cause puerperal fever

In lying-in hospitals devoted to the instruction of midwives, the first named source is lacking, and this is the reason for the more favorable state of health in the division for midwives. Although in the midwives' division ichorous discharges may be found, these discharges cannot infect so many individuals in the midwives' division, as do the ichorous discharges in the physicians' division along with the decomposed matter derived from the cadaver; if therefore in the midwives' school in Vienna perchance at some time a diseased patient was to be found, who would serve as a source of infection, then these sources are still not sufficient to decrease the remarkable difference in the state of health in the two divisions, or to equalize them, because such diseased individuals are also found in the physicians' division, (p 304) in addition to the decomposed matter derived from the cadavers

Yet figures will settle every doubt We shall cite the yearly report of each division since its establishment, down to the introduction of the chlorine washings, as proof (see Table No XLV).

From Table No XLV the reader will perceive that the mortality in both divisions, as long as the medical students and pupil-midwives were assigned in equal numbers to both divisions, i.e in both divisions, the infection came from the three sources. The significant difference between the two divisions began first with the assignment of all medical students to the First Division, and all pupil-midwives to the Second, or in other words, among the midwives one source of infection was shut off, viz, from the cadaver, but flowed more profusely into the First

But this does not mean that the state of health in the midwives' division was in general a more favorable one. The reader will recall that we demaned, as the most lenient standard for a lying-in

hospital, that less than one out of 100 puerpera should die, how far even the midwives' division in Vienna is from fulfilling this demand is shown by the following table

TABLE LXV

Medical Students and Pupil-midwives Assigned to Both Divisions in Equal Numbers

(This portion of the table is the same as No XXII, on page 139)

By a high government decree of October 10, 1840, all medical students were assigned to the First Division, and all pupil-midwives to the Second

Year	Births	Deaths	%	
	First I	Division		
1841	3036	237	7 80	
1842	3287	518	15 75	
1843	3060	274	8 95	
1844	3157	260	8 23	
1845	3492	241	6 90	
1846	4010	459	11 44	
	20042	1989	9 92	
	Second	Division		
1841	2442	86	3 52	
1842	2659	202	7 59	
1843	2739	164	5 98	
1844	2956	68	2 30	
1845	3241	66	2 03	
1846	3754	105	2 79	
	27791	691	3 38	

(p 306) Finally, Prof Levy says. "These are my impressions of Dr Semmelweis' experiments, which for the present I wish to have accepted as the motive of my provisional judgement, that his views are not sufficiently clear, and his findings not exact enough for the establishment of a scientific conclusion"

There remains nothing further for us than to recommend to Prof Levy a diligent study of this work, and we do not doubt that he also will be convinced that, instead of the colossal folly, promulgated up to now on the origin of childbed fever, I have erected a definite scientific structure which lacks only a wide circulation in order to carry out the beneficient purpose for which it is intended

Before we continue with Prof Levy's correspondence, we believe that it would be opportune to publish here a letter from Professor Dietl of Cracow, in connection with a matter to which we shall refer later, we applied to Professor Dietl for some necessary information, after granting my request, Prof Dietl supplied many other points of interest which we quote here. "Everywhere on my journey, I noticed that your views on the origin of puerperal fever were given consideration in the arrangement of the lying-in hospitals, and that the sick patients as well as the physicians were carefully isolated, in that the latter especially were allowed no contact with cadavers, as in Copenhagen. With what results, I admit I cannot say.

"Direct inquiries to the medical directors of these institutions should supply you with the information you wish

(p 307) "On the whole, one now hears much less of these devas-

tating puerperal epidemics

"Perhaps the cause will be found in the observance of those arrangements, based upon your experience, without acknowledgement of their worth to one's self or to the public

"The investigation of the truth is well worth a journey around

the world

Cracow, April 28, 1858"

We now return to Professor Levy

I answered Professor Levy with an attempt to clear up the difficulties which he had raised, and remarked in conclusion, that it would be more important to me to know what he now considers the truth after ten years of observation, than to know what doubts he entertained ten years ago

After allowing sufficient time for an answer, I wrote him again. In this letter, I said that I knew that the Copenhagen Lying-in Hospital had previously suffered such a visitation by childbed fever as threatened the hospital's very existence (See p 153, line 17), and quoted what Professor Dietl had said about the Copenhagen Lying-in Hospital

Professor Braun had said "Since this is the most excellent and notable newly built lying-in hospital, in which every effort is made to keep out puerperal fever epidemics, we permit ourselves to draw up a short sketch, with the remark that in this new building there should indeed be no puerperal fever epidemics while under Levy's direction," and appended thereto the observation that he thought the improved state of health could be attributed to the fact that my views on the origin of childbed fever (p 308) were decisive in the use of measures for the prevention of childbed fever

Thereupon I received the following answer

Copenhagen, September, 21, 1858

"The day before yesterday I received your esteemed letter of the 16th of this month, and your urgent demand compels me to have the answer follow today

"But first I must report that I have received no answer to my letter of May of this year, and that I have learned for the first time from your letter that my letter was actually received. I must confess that it is not quite clear to me, how you can put the question to me "whether as a result of your views on the genesis of puerperal fever, the changes in the Copenhagen Lying-in Hospital were made, and with what results." Your opinion was that puerperal fever was caused chiefly by cadaveric infection, and even if it were known to us at that time, could have had no influence on the alterations and the hygienic organization of our lying-in hospital. So I cannot comprehend at all what influence it could have had on the arrangement of any such institution

"As a precautionary measure in the conduct of the institution, it is to be assumed that one must be on guard against the transfer of cadaveric matter during the exploration of the parturients, but beyond that I can conceive of no influence upon further arrangements of the institution

"I believe that I have expressed myself clearly enough on how I have understood your views And if you have accorded sufficient attention to my letter, you will recall that we, out of regard for contagionistic scrupulosity, have sought to protect ourselves from puerperal cadaveric infection, long before your views came to light

"It may be that later, out of regard for your views, we also became more cautious than formerly with autopsies on non-puer-peral cadavers, but they were done by our own staff nevertheless, while the autopsies on patients dead of puerperal fever were done by outside help

"What part such precautionary measures may have had on the improved state of health in the institution cannot be estimated if, at the same time, the extremely important changes in the structure of the building and in the administration are carried out."

What disinterested person in the reading of this letter does not recall Prof Dietl, who says: "On the whole, one now hears much less of these devastating puerperal epidemics. Perhaps the cause will be found in the observance of those arrangements, based upon your experience, without acknowledgement of their worth to one's self or to the public."

If Professor Levy says, that there can be no estimate of the part these precautions have played in the improved state of health, because at the same time extremely important changes in the structure of the building and in its administration then it is certain that the atmospheric-cosmic-telluric conditions of the city were not changed, and therefore the previous large mortality among the puerperae in the Copenhagen Lying-in Hospital was not due to atmospheric influences, i.e there was no epidemic

And if as a result of measures which aim to prevent the introduction of decomposed matter into individuals from without, the state of health in a large lying-in hospital was improved, then this is a proof of the correctness of my doctrine on the origin and prevention of childbed fever.

⁽p 310) The letter from C B Tilanus of Amsterdam reads as follows

[&]quot;In the interests of science, I consider it a duty not to withhold from you my views, based upon experience, of the causes of the epidemic behaviour of childbed fever in lying-in hospitals, while I answer your questions directed to me through Dr Stendrichs

"During my twenty years service as director of this institution, I have gone into this matter as closely as possible and have found no reason for deviating from the opinion, which I have held for a long time, that the dissemination and persistence of this disease among the puerperae, if it has arisen out of atmospheric conditions, in addition to which the *Constitutio annua* in winter and spring especially is due to frequently varying climate, is to be attributed to the variations in contagiousness

"On the one hand, my conviction is based upon the frequently demonstrable origin of the disease from a patient already ill during labor, sometimes already sick on admission to the hospital, and who soon died and its transmission to the healthy patients who were delivered at the same time or soon after and who were in the immediate neighborhood of the original diseased patients, yet died before the ominous disease was diagnosed. On the other hand, the epidemic soon comes to an end if the births on some days decreased in numbers or wholly ceased, and the diseased patients could be isolated so that their care could be turned over to attendants, who scrupulously kept away from the ensuing labors, and from the new puerperae

"It is understood, of course, that for such practices a relatively small institution (in ours, an average of 400 births annually) is alone suitable, and this also explains, if I mistake not, why opposing views have been held for so long in the large hospitals, (p 311) although the explanation of communication by a contagium is somewhat against it, either in theory or analogy Most striking, indeed, is the analogy with septic fever and the septic atmosphere, which menaces the freshly wounded mixed in the surgical wards with diseased patients, and a newly delivered patient, even under physiologic conditions, is certainly a freshly wounded patient

"As for your view of the cadaveric contagium as a cause of the disease, I concur with this out of my innermost conviction. In years gone by, I have, in single cases, so established this mode of origin, that since then I have taken the most rigorous precautions to avoid this misfortune.

"The Assistant and the students, who make the examinations

and attend the deliveries, must wholly abstain from work in anatomy. The autopsies on cadavers dead from puerperal fever must be done by men from the medical or surgical departments, or by other students, while those students, who are not on call, are allowed to attend these autopsies and see the results, but are severely forbidden to contaminate their hands while there. I am convinced that we dare not sacrific the human beings entrusted to our care to a curiosity which in its own time can sooner or later be gratified.

"That these complications can be decreased by scrupulous cleansing with chloride of lime solution, I will concede, (we use it all the time, for the nurses of the sick in the hospital, as well as at the autopsy table), but they are not to be prevented entirely through these precautions

"We do not know the nature of the cadaveric poison, and we cannot know, whether it would be destroyed by our methods for disinfection. At any rate, experience does not speak for it, when we observe that neither puerperal nor septic fever, nor the exhalations of hospital gangrene (p. 312) are eradicated by cleansing the wards and fumigating with chlorine vapor, if the infected rooms are not abandoned immediately for a long time and exposed to an uninterrupted current of air.

"It gives me pleasure to report, in conclusion, that during this winter, after I had received Dr. Stendrichs' letter, the state of health among the puerperae was on the whole favorable in our institution, and we have seen only single cases of sporadic fever. Out of 133 births from November to February, there were two deaths In December, the disease threatened to become epidemic at the beginning of the winter cold, as five newly delivered patients were severely attacked inside of three days, but fortunately all were cured by an energetic antiphlogistic treatment Since then the weather has remained the same for six weeks and no frost has set in. Such a spell of even temperature in our territory is an exception, particularly in the spring. Last year there were twelve fatal cases from January to April, from May to September not a single one and in October there were two

"In the last months, the labors were pretty evenly distributed,

so that no overcrowding occurred, and there regularly took place the change of locale, which in the last years on my urgent instigation was so extended, that in ordinary times the space was only half occupied

"I conclude with the wish that, in the interests of mankind, your efforts may give a mighty shock to the pernicious unbelief in the contagiousness of this disease and in the harmfulness of the cadaveric poison, which just recently has found an advocate in the otherwise able Kiwisch von Rotterau, by whom we are assured that he frequently cares for parturients as well as the newly delivered patients immediately after doing an autopsy. (p. 313) Such an assertion has certainly a horrible sound, and at the same time, for the inexperienced, it can only lead to foolhardy negligence. It is a pity that there are quite a number of noxious influences which can cause the disease, due to the general disposition of the puerperae, and yet are beyond our reach, and consequently nobody will believe that from our point of view the destruction of these things will be an easy matter

Amsterdam, March 9, 1848."



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The Etiology, the Concept and the Prophylaxis of Childbed Fever. III

 $\mathbf{B}\mathbf{Y}$

IGNAZ PHILIPP SEMMELWEIS.

Doctor of Medicine and Surgery, Master of Obstetrics, Professor of Theoretic and Practical Obstetrics at the Royal Hungarian University in Pest, etc., etc

Pest, Vienna and Leipzig
C A Hartleben's Verlags-Expedition

1861

Translation By Frank P Murphy, AM, MD
Associate Professor of Obstetrics, Creighton University School of Medicine

Indeed the facts are not new, only the conclusions which I drew from the old facts are new, since it is a fact that within the lying-in hospitals the cases of sickness and the deaths are much more frequent than without, so I draw from this old fact the new conclusion that the numerous cases of disease and the deaths in the lying-in hospitals could not be due to atmospheric influences, since the puerperae within and without the lying-in hospitals are exposed to the same atmospheric influences, and consequently must fall ill and die in the same degree. And if Scanzoni and the legion of epidemicists in spite of these facts believe that child-bed fever is due to atmospheric influences, then that only proves that the contradiction between the theory and the facts is not evident to them due to a lack of consideration, or if they have

perceived the contradiction, then they have accepted the erroneous concept of epidemic puerperal fever, because they have nothing better to put in its place.

Scanzoni says: "Skoda further calls attention to the morbidity and the mortality ratios of the two obstetrical divisions of the Vienna hospital, which show that the number of deaths in the First Division was constant up to June 1847, in 1846 it was even five (p. 317) times greater and the average over a period of six years was three times as great as in the Second Division."

The reader will recall what new conclusions I drew from this old fact, this old fact gave me all the means I needed for my campaign against the hitherto accepted etiology of childbed fever, and shows that, if in the period represented by Table No. I, three puerperae died in the First Clinic, not counting the transfers, one could indeed find the etiologic factor of childbed fever for the two others in the hitherto accepted etiology. This old fact convinced me, that another factor must necessarily be found outside the hitherto accepted etiology of childbed fever; I have searched for the unknown cause and have found it.

Scanzoni says further. "Dr. Semmelweis, in his recognition of the fact that pyemia is caused by the action of putrescent organic matter upon the blood, has conceived the idea that the transfer of such a substance to genital organs is the reason for the frequent illnesses among the puerperae, and considers such an infection possible, because this noxious matter adheres to his and the students' hands for some time after the numerous postmortem examinations, and is transferred to the genitals of the patients during the vaginal examinations. In favor of such an opinion speaks the significantly more favorable state of health in the Second Division, where the midwives have nothing to do with autopsies, and also the fact that the sickness increases if the Assistant and the students visit the dead-house frequently.

In order to prove the correctness of his opinion, in May 1847, Dr. Semmelweis ordered that every one must wash his hands with chlorine water (p 318) before every examination of a gravida, parturient or puerperae. As a result of this procedure, the sickness among the puerperae in the First Division was suddenly

reduced to a level below that in the Second And certainly, if this procedure, which could do no more than to destroy the decomposed matter adhering to the hands, can reduce the mortality in this division to 45 deaths out of 3556 puerperae, where previously over a period of six years with a lesser number of puerperae, with the exception of one year, it had varied between 237 and 518 deaths yearly (See Table No I, p 100), then it is indubitably proven that the decomposed matter was the cause of the great mortality. In 1841 there were 192, in 1845 196, in 1844 215, in 1843 229, in 1846 414, in 1842 463 more deaths than in 1848, when the chlorine washings were supervised by me throughout the whole year.

Scanzoni says. "Following the history of the devlopment of the discovery made by Dr Semmelweis, Professor Skoda turned to the measures necessary to put this discovery beyond all doubt, among them the letter which Skoda sent to Nadherny"

Scanzoni says. "Professor Skoda asserts that he offered to introduce the chlorine washings into the Prague Lying-in Hospital, yet this invitation, as far as is known to us, did not come either from him or from Dr Semmelweis in a manner suitable to the importance of the affair. At least we obtained our information on the measures recommended by Dr. Semmelweis through physicians who chanced to come to Prague from Vienna A direct invitation by letter from either of the two physicians named never reached the authorities at the Prague Lying-in Hospital"

(p. 319) The reader will know how he should take Scanzoni's account of the matter, when he compares it with what we have said on the subject

Scanzoni opposes Skoda's statement, that the chlorine washings up to that time were either used not at all, or with insufficient zeal, with the assertion that after the experience of the Vienna Lying-in Hospital became known to them, they were introduced in Prague and were carried on most zealously under careful supervision of the students, as could be verified by anyone who has attended the clinic at Prague at that time

And in order to off-set the report which, following Scanzoni's statement, was circulated in Vienna, that during the period of

his assistancy the mortality ratio was an appallingly unfavorable one, and that it was to be attributed to his failure to use Dr. Semmelweis' chlorine washings, Scanzoni published the monthly reports of the Prague Lying-in Hospital from May 1, 1847 to August 31, 1848, a period of 15 months, during which the chlorine washings were practiced only for four and a half months

This report shows that during these 15 months 45 out of the 2721 puerperae cared for died, 1 e 1.6%, while in the First Obstetrical Clinic in Vienna from June 1847 to April 1848, when the chlorine washings were practiced uninterruptedly under my supervision, there was a mortality rate of 25%, and consequently in the Prague Lying-in Hospital there is a mortality rate about 09% more favorable than in Vienna, (p 320) although at Prague no chlorine washings were used over a period of ten and one-half months

Scanzoni relates further, that out of the puerperae transferred to the general hospital 41 died, adding these 41 deaths to the 45, who died in the Lying-in Hospital, one finds a mortality of 86 out of 2721 puerperae, or 31%

So, Scanzoni goes on, if a comparison is to be made between the results of the two lying-in hospitals, it would be very desirable if the Vienna institution would state whether any and how many puerperae were transferred to other parts of the hospital. But even if, in Vienna, absolutely no transfers had taken place, which cannot be assumed, because Professor Skoda himself states that sick puerperae were sometimes transferred from the lying-in hospital to the general hospital, yet our mortality rate remains only 0 6% less favorable, a difference, which in the eyes of every unprejudiced person would certainly appear much too insignificant to be considered a reproach to our institution for inculpation and impeachment of the physicians in charge

We can now assure Scanzoni, that the transfers of which Skoda speaks, occurred before the chlorine washings were introduced and indeed Skoda cited these transfers as proof that the mortality at the First Clinic before the introduction of the chlorine washings was even more considerable than the figures showed, because from time to time transfers in great numbers were made,

thus making the mortality statistics more favorable than was actually the case, after the introduction of the chlorine washings there were transferred only a few cases, one at a time, who on account of their condition were a source of danger to the other patients, and Scanzoni may be assured that I would (p 321) soon be unmasked if I had gotten rid of the sick puerperae in order to reduce the mortality, and then attributed this reduction in mortality to the chlorine washings

So that a standard may be set up, so that the reader may judge the reports published by Scanzoni, we shall recapitulate some relevant matter

The reader will recall that the question, if through the precautions taken all cases of infection from without were prevented, then how many puerperae died as the result of unavoidable infection, was answered by the statement that our own experience on this point could give no certain decision but that we thought the report of the Vienna Lying-in Hospital, during the time when Medicine was still not based upon anatomical principles, would be suitable information on this point. In these 39 years, there were 25 years, in which less than one puerperae out of 100 died (See Table No XVII, p. 62 and Table No XXIV, p. 142)

And there died during 2 years less than one of 400 puerperae, during 2 years less than one in 300, during eight years less than one in 200, and during 13 years less than one out of 100

We make, therefore, no severe demads on a hospital, when we require a mortality of less than one out of 100 puerperae

If then from the report published by Scanzoni, it appears that in the Prague Lying-in Hospital during the 15 months cited, 3.1% of the puerperae died from childbed fever, it is thereby proven that cases of infection from without occurred there, and if Scanzoni says that at the same time in Vienna, in spite of the chlorine washings, an equivalent number of deaths occurred, then the reader will recall, that we at that (p 322) time did indeed have numerous cases of infection from without in spite of the chlorine washings, because at that time we were still so inexperienced that we did not wash our hands in the chlorine solution after

the examination of a patient with medullary carcinoma of the uterus, that we failed to isolate the patient with the carious knee, and that at that time we had to complain about the students, who did not show sufficient respect for the regulations on the chlorine washings. In the Vienna Lying-in Hospital before medicine was based on anatomic principles, during these 39 years, there were 25 years in which less than one out of 100 puerpera died, seven years with one out of 100, five with two out of 100, one with three out of 100, and one year with four out of 100, and then the mortality increased as a result of the anatomic trend in medicine to the degree that the mortality of the lying-in hospital taken as a whole in a year reached the high-point of 12%, the First Clinic by itself 15% and one month 31%

The medical school in Prague like the one in Vienna is on an anatomic basis, if, in Vienna, the anatomic trend of medicine brought so much misfortune to the Vienna Lying-in Hospital, so must it also be the case in Prague, since the laws of Nature are the same in Vienna and in Prague. The natural conclusion is that the Prague Lying-in Hospital must have seen rather sorrowful times during the 15 months reported to us by Scanzoni. This hospital, as in Vienna, is divided into a clinic for physicians and one for midwives, and certainly the situation there must be the same as we found in Vienna and Strassburg, namely, that there prevailed in the two divisions of one and the same institution a strikingly different state of health, and certainly not the more favorable on the part of the clinic for physicians, if the difference was not equalized by the regular transfer of sick puerperae into the general hospital.

For our assertion that the Prague Lying-in Hospital (p. 323) must have seen rather sorrowful times during the 15 months reported to us by Scanzoni, we need no other support than that in the Vienna Lying-in Hospital the situation was similar

Over and above this, Scanzoni tells in his Textbook of Obstetics what great experience he had acquired in the Prague Lying-in Hospital from the number of cases of childbed fever he had observed, experience which could only have been acquired in a lying-in hospital which had been unmercifully afflicted by the disease.

However, before we take up Scanzoni's enormous experience, it is necessary to make a critical examination of his classification of the inflammations as they occur during the puerperium

He divides the puerperal inflammations into those which run their course with or without a resultant disintegration of the blood. According to Scanzoni the latter should not be called puerperal fever, but, if in the course of the disease a resorption of the inflammatory products takes place, these can turn into puerperal fever, if a disintegration of the blood occurs as a result of the absorption of the inflammatory products. Here belong endometritis, metritis, metrophlebitis puerperalis, metrolymphangitis, peritonitis puerperalis, peritoneal oophoritis, parenchymatous oophoritis, puerperal inflammation of the pubis, colpitis puerperalis and such cases as are preceded by a disintegration of the blood. These cases are the real puerperal fever, here belonging hyperinosis, pyemia and the blood-dissolution of the puerperae.

And although at the bedside, as well as on the autopsy-table, cases are observed which are included under hyperinosis, others which are classified under pyemia, and others under blood dissolution, and still others, which cannot be classified under any of the three forms named, (p 324) which according to Scanzoni are to be numbered among the inflammations which are not puerperal fever, yet it is indeed certain that all these forms are resorption, or to use the common usage, puerperal fever, because all these forms are engendered as a result of the absorption of a decomposed matter, but why the absorbed decomposed matter produces at one time the form called blood dissolution, and once again, the forms which cannot be included under the terms named, that we do not know, as we have already stated when we clarified Professor Levy's doubt Perhaps this depends upon the greater or lesser degree of putrefaction of the absorbed matter, perhaps upon the capacity for reaction in the organism, perhaps upon other circumstances We know only for certain that in all these cases a decomposed matter is absorbed which, many times in a manner not recognizable by our senses, obviously caused a disintegration of the blood, and that as a result of this blood-disintegration the inflammations set in And that also in those

cases where an obvious blood disintegration did not occur, which on that account was not recognized by Scanzoni as puerperal fever, actually a decomposed matter was absorbed, is proven by the fact that these cases also could be prevented by the chlorine washings.

In the year 1841 there died 192, in 1845, 196, in 1844, 215, in 1843, 229, in 1846, 414, in 1842, 463 more puerperae than in 1848, when the chlorine washings were practiced, and yet these 1709 more dead puerperae in the six years were not clear cases of hyperinosis, of pyemia, or of dissolution of the blood, but the greater number were certainly cases where an obvious blood disintegration could not have been observed, and still they would have been prevented by the chlorine washings, as a proof that even these cases occurred as a result of the absorption of a decomposed (p 325) matter, and that they were therefore cases of resorption or of puerperal fever.

I hope the reader will not be impatient because I continually return again to the improved state of health in the First Obstetrical Clinic, but the result of the chlorine washings is certainly the rock on which to dash my opponents to pieces

After we have proven by the results of the chlorine washings that the inflammations during the puerperium which Scanzoni will not recognize as puerperal fever, are identical during the lying-in with those which Scanzoni does recognize as puerperal fever, we shall return to the enormous experience which he had in Prague in relation to the number of observed cases of puerperal fever

In a petition which he directed on March 29, 1849 to the Bohemian State Government, Scanzoni speaks of his more than five years' service at the Prague Hospital In November, 1850, he began his activity as an instructor in Wurzburg, consequently Scanzoni has served seven years at the hospital in Prague. How many births occurred in Prague during these seven years, I am sure that I do not know, but if we take twelve of the fifteen months reported by Scanzoni as a basis, then it may be assumed, since 2210 births occurred from June 1, 1847 to the last of May, 1848, that 15,470 births took place during these seven years

If we now require of the Prague Lying-in Hospital, that less than one out of 100 puerperae should die of childbed fever, then during these seven years there would be approximately 150 And that this demand is justified we can prove by the deaths. fact that, in spite of unfavorable conditions, we lived up to this requirement for seven months of the year 1848 in the First Clinic in Vienna, for six years in the St Rochus Hospital at Pest, and for one year in the Obstetrical Clinic at Pest In Vienna, during (p. 326) the time when medicine was not yet upon an anatomical foundation, there died during 25 years 273 out of 44,838 puerperae, i e. less than one out of 100 (See Table No. XXV, p. 192), and during the 262 years for which we possess the reports for four London and two Dublin hospitals, there were 19 years in which not one out of 4558 puerperae died, during 105 years there died 726 out of 109,656 puerperae, i.e. likewise less than one out of 100 (See page 176, line 3 from below).

If now at an institution in which during a period of seven years there could have been only 150 fatal cases of puerperal fever as a result of auto-infection, assuming that all cases of infection from without were prevented, Scanzoni* can observe such a tremendous number of cases of puerperal fever that, although he divides the puerperal inflammations into many forms, nevertheless he can speak of only one, i.e endometritis, and in the Prague Lying-in Hospital he has had the opportunity to treat hundreds of puerperae suffering from endometritis and indeed without success, he tells us that he has been convinced that the problem of the physician in the handling of this disease consists only in the combatting of the most distressing and the most dangerous symptoms (See 1st Ed, Vol III, p 380, 2nd Ed, Vol III, p 948)—

If Scanzoni can say of metritis, that he has attended hundreds of post-mortems on dead puerperae (See 1st Ed, Vol III, p 382, 2nd Ed, Vol II, p 950)—

If in another place Scanzoni reiterates that he has attended hundreds of post-mortems on women dead of puerperal fever (See 1st Ed, Vol III, p 464 and 2nd Ed, Vol II, p 1010)—

^{*} Lehrbuch der Geburtshilfe, Wien

(p 327) If Scanzoni can tell us, "that in the course of an epidemic single, stormy, damp chilly days exert an unmistakably unfavorable influence upon the more frequent and more intensive appearance of the disease, so that frequently all the puerperae in a lying-in hospital become ill of puerperal fever on a certain day, such as we observed in October, 1846 in the Prague Lying-in Hospital, where we counted 13 sick on one day (See 1st Ed, Vol. III, p 462, and 2nd Ed, Vol. II, p. 1009)—

If Scanzoni can have such an enormous experience, then the sorrowful humanitarian can estimate what a horrible waste of human life took place also in the Prague Lying-in Hospital His figures are for the months only, but consider the legion of infants, scarcely born, who were infected through their mothers and must have died of the same blood disintegration

The humanitarian finds scant comfort in the circumstance that, although the least possible mortality was not attained during the 15 months covered by Scanzoni's report, it was better than previously, because even with such a mortality such a tremendous experience could not be acquired, aside from the fact, that during his seven years period of service at the Prague Hospital, he could only have observed a part of the cases of puerperal fever; as long as he was assistant, all those cases could have escaped his observation which were transferred to other divisions, and while he was director of the gynecological division, he could only have seen those cases which were transferred to this department.

And why not, since many physicians travelled by chance from Vienna to Prague, who recounted there the methods recommended by Dr. Semmelweis for the prevention of puerperal fever, and thereby made the attending staff of the Prague Lying-in Hospital more cautious?

(p 328) On this occasion who does not remember Dietl's statement? "On the whole, one now hears much less of these devastating puerperal epidemics, perhaps the cause lies in the observance of those arrangements which are based upon your experiences ... without acknowledgement of their worth to one's self or to the public."

Scanzoni says. "As for the observed results of the chlorine

washings in the Prague Lying-in Hospital, it may be stated, that in March, 1848, when puerperal fever occurred more frequently and in a virulent form, this procedure was instituted for the first time and was carried out persistently through the latter half of of March, as well as in the whole of April following

"But since the number of cases of illness certainly did not diminish, even though in this period we visited the autopsy-room extremely seldom, the chlorine washings were set aside for a time as an experiment, and what these washings, adopted and supervised with the greatest conscientiousness, failed to do, was accomplished by a more favorable *Genius epidemicus*, the number of cases of illness suddenly decreased, so that in May out of 205 puerperae only one fatal case occurred, while in March and April, when the washings were done with chloride of lime, 31 deaths occurred out of 406 cases delivered.

"After we had become convinced that this procedure was not capable of putting a stop to the frequent outbreaks of disease among the puerperae, it was incumbent upon us to find out whether this procedure was adequate to prevent the appearance of such puerperal epidemics in the lying-in hospital. The washings were therefore re-introduced in the beginning of June, and without any cause whatsoever being demonstrable, 21 puerperae fell sick in June, 9 in July, 261 in August; out of the 21 cases in June nine died, out of the nine in July two died, and out of the 26 in August eight died. How this striking variation (p. 329) in the number of cases may be explained, if so great an influence may actually be attributed to the chlorine washings and the frequency of the disease could only be dependent upon the cadaveric infection occurring during the vaginal examination, we are unable to state, lacking any basis of proof."

We cannot deny our admiration for the penetrating sagacity of Scanzoni, which permitted him to set aside the chlorine washings as an experiment, because ordinary common sense would have been as satisfied with the period from the day of the opening of the Prague Lying-in Hospital to the day of the introduction, as with the period at the hospital during which the chlorine washings were set aside as an experiment, and in this connection we

recommend to Scanzoni the diligent study of our Table No XXIV printed on p. 142 in reference to the Vienna Lying-in Hospital. We cannot indeed conceal from ourselves, that by this experiment his conscientiousness appears in a less favorable light, because at the time when he made the experiment, Scanzoni was not completely convinced that the chlorine washings were not capable of preventing childbed fever, and this conviction was first strengthened in him by the fact that, in spite of the disuse of the chlorine washings, the mortality decreased, and that, in spite of the renewed use of the chlorine washings, the mortality rose again. But what if my views were indeed established, and what if, in spite of the abandonment of the chlorine washings, a greater mortality did set in? Is it scientific to make such experiments?

The reader will recall that in April, 1847, we had 57 deaths at the First Obstetrical Clinic and 36 in May.

About the middle of May we introduced the chlorine washings, and thereupon the mortality decreased to 6 deaths in June, to three in July, to five in August, but in September rose again to 12, in October to 11, (p 330) in November to 11, and in December to eight From this increased mortality in spite of the chlorine washings, we did not draw the conclusion that they were futile, but the increased mortality raised in us the suspicion that, perhaps in spite of the chlorine washings, decomposed matter was being introduced into the patients, and an investigation made for this reason showed that some of the students were slighting the chlorine washings We found, that after the examination of a parturient suffering from a cancer of the uterus we did not wash our hands in chloride of lime, just as we did not isolate the woman with the carious knee, with all of which the reader is already familiar, for these reasons we did not abandon the chlorine washings, but on the contrary, we practiced them even more assiduously, with the happy result that during seven months of 1848 we lost less than one of 100 puerperae, and we would probably have been more fortunate in 1849 and 1850, if, despite our petition, the opportunity had not been refused us to supervise the chlorine washings during these two years also at the First Obstetrical Clinic

As for the experience which I have had in Pest, and the experiences of others to which I have already had the opportunity to refer, we shall only hint at them here

Scanzoni has erred grievously when, after an unhappy experiment of not quite six months duration, he drew the hasty conclusion that the chlorine washings did not exert such a great influence and that the frequency of the disease was not due to the cadaveric infection occurring during the vaginal examination

The reader has certainly read the weighty arguments brought forward against me by Scanzoni, who undoubtedly has not concealed them from his students, and from this circumstance, after his failure to reduce (p 331) the mortality suddenly as had been done in Vienna and after the mortality rose again in spite of the recently adopted chlorine washings, he could conceive the idea that perhaps the students would cease washing as conscientiously as necessary just on account of these weighty arguments, and what is even more likely, that such would be the case even among my students, although I so earnestly urged the chlorine washings upon them

It would therefore have been much more conscientious for the sake of the experiment to have abandoned, not the chlorine washings, but the enumeration of such unanswerable arguments against the chlorine washings

Scanzoni has failed in still other respects, but he cannot be made answerable for them because he has the excuse of ignorance

Of the three sources from which the decomposed matter which causes childbed fever is derived, Scanzoni of course knows only the one, i.e. the cadaver, and regarding this Scanzoni says. "We (under which he probably includes also his students) visited the autopsy-room extremely seldom during this period." The great source of decomposed matter, i.e. all patients whose disease engenders a decomposed matter, at that time at least was unknown to him, and in all probability at the Prague Lying-in Hospital the same happens, as we found to occur in Vienna in the cases of the uterine cancer and of the carious knee, when we did not yet know that decomposed matter can come from diseased patients. If Scanzoni at that time believed that decomposed

matter came only from the cadaver, then he certainly did not require the chief midwife of the institute along with the other personnel who had nothing to do with cadavers, to practise the chlorine washings, and he probably did not stringently isolate the utensils used by the diseased patients from the healthy patients, and thereby nullified the result of the chlorine washings.

Lastly, the decomposed matter can also be derived from the third source; (p 331) I have already related to the reader, that in spite of my vigilance during the two years in the Pest Obstetrical Clinic, it happened that we had cases of infection from without because of dirty bed-linen and laundresses and nurses who did not do their duty, and this could indeed happen in Prague also.

If I were now in Scanzoni's place and he in mine, and I could not say to him with full truth, that I had zealously put the chlorine washings in practice, then the conclusion, that childbed fever does originate through the resorption of decomposed matter, would be a false one

And if Scanzoni says that he had no conclusive facts to explain the striking variation in the number of cases of the disease, if the chlorine washings actually have such a great power, and the frequency of the cases of disease was only due to cadaveric infection occurring during the vaginal examinations; if Scanzoni asks this, then we can recommend to him the diligent study of this work without delay to obtain such conclusive facts. But I think that Scanzoni would be in greater difficulty if we should request him as a return favor to tell us where information on the etiology of childbed fever can be found which will prove that in March and April, 31 out of 406 puerperae died fortuitously and that these fortuitous deaths were reduced to one by a more favorable Genius epidemicus, and that again, without any demonstrable cause, nine died in June, two in July and eight in August.

If Scanzoni, while defending himself against Skoda's accusation of not having carefully practised the chlorine washings, regales us with such a foolish rigmarole on the etiology of childbed fever, then the reader, like myself, must conclude that Skoda was too gentle in his criticism

If the Prague Lying-in Hospital collapsed and these patients

were killed, then Scanzoni could have ascertained (p 333) the cause of the deaths, but whether decomposed matter had been conveyed in one way or another in greater or lesser quantities, upon which not only the cases of the disease, but also the variations in the number of cases are dependent, is not a demonstrable cause for Scanzoni, so long as he has no conclusive facts by which these variations can be explained.

Scanzoni says further. "We cannot however refrain from mentioning that at the Prague Lying-in Hospital the hypothesis advanced by Dr Semmelweis and defended by Professor Skoda could indeed find no application, because there, on the one hand, only extremely few mothers were examined after delivery, during which occur the genital injuries disposing to the absorption of deleterious matter, while, on the other, the students working in the hospital came in contact with cadavers only in exceptional cases over periods of several days, which fact will be corroborated by anyone familiar with the conditions in our establishment"

The reader has seen that up to this time Scanzoni has always spoken of a discovery and has made no reproach against the facts and conclusions upon which this discovery is based, other than that they are not new, Scanzoni has nowhere demonstrated that the facts are not true, nor that the conclusions are erroneous Only the final result of these facts and conclusions, ie that child-bed fever originates through the resorption of a decomposed matter, Scanzoni has not found corroborated by the experiments, which he conducted in Prague, Scanzoni's experiment has shown that in March and April, 1848, 31 puerperae died fortuitously, that these fortuitous deaths were decreased in May by a more favorable Genius epidemicus, and that, in June, July and August, 16 puerperae died without any demonstrable cause

(p 334) For this reason he calls my discovery an hypothesis We maintain that we made a discovery and think the reason why our discovery made in Vienna is degraded to an hypothesis in Prague is to be found in the fact, that Scanzoni has not been enlightened on the essential points of this discovery, and we have already shown that Scanzoni knows only one of the three sources of the decomposed matter, and even in this connection, he does

not seem to have wholly made up his mind, because he says that frequently his students in the course of several days do not come in contact with cadavers. Each student spends two months in the practical obstetrical course, in Vienna, there are 42 students, how many in Prague we do not know, perhaps 20, and if those 20 students come in contact with the cadaver only once a week, then there are 160 contacts for the two months and 960 for one year, sufficient for the tremendous experiences accumulated by Scanzoni in connection with the number of observed cases of puerperal fever in the Prague Lying-in Hospital and sufficient to let 31 puerperae die fortuitously along with 16 deaths without demonstrable cause, if the chlorine washings are badly supervised.

And if Scanzoni says that this hypothesis can accordingly find no application in the Prague Lying-in Hospital, because there only extremely few mothers are examined after delivery, during which the injuries to the genital tract occur, which dispose to the admission of deleterious material, then we can assure Scanzoni that likewise in Vienna only extremely few mothers are examined after delivery, but by this statement Scanzoni has shown that he is mistaken as to the place where the decomposed material is absorbed and also as to the time when it is absorbed

The place where the decomposed matter is absorbed, is the internal surface of the uterus from the internal os upwards, where as a result of pregnancy the mucous membrane is lost; as a result of injury (p. 335) any place on the body, and likewise any place on the genitals can become a site for absorption, the time for absorption is during pregnancy, if the internal surface of the uterus is accessible. During labor it becomes infected most frequently during the period of dilatation as a result of the examinations, during the stage of expulsion no infection can occur, because the advancing fetal parts render the absorptive internal surface of the uterus inaccessible, during the placental stage and during the puerperium infection can occur through the internal surface of the uterus or at points on the genitalia injured during labor, but at these periods examinations are less frequently made Infection occurs more often because wounded places on the in-

jured genitalia come in contact with objects which are contaminated by decomposed matter, here belong—soiled bed-linen, sponges, bed-pans, etc, etc, or infection occurs at these times, because the atmospheric air, permeated by decomposed matter, penetrates into the patient's genitalia Scanzoni says. "Professor Skoda considers it a duty to call

Scanzoni says. "Professor Skoda considers it a duty to call the attention of the medical professorial college of Vienna to the importance of the discovery made by Dr. Semmelweis and to request them to nominate a commission, which would have the following assignments to fulfill:

- "a) There should be prepared a table in which, as far as the data would extend, the number of deliveries and deaths from month to month would be given, and a list of the Assistants and students, in the order in which they had attended and practised at the lying-in hospital Those Assistants and students who had been participating in the autopsies, should be singled out,—and from this list Skoda (p 336) would determine whether the number of cases of the disease in the lying-in hospital had any relation to the participation of the Assistants and students in the autopsies
- "b) The so-called street-births should be sorted out, because, if Dr. Semmelweis' opinion is correct, the women delivered in the street were examined only in case of urgent necessity after reaching the hospital, and there must be fewer cases of illness among them
- "c) It may be shown by collected reports, whether in all institutions, where infection by cadaveric poison could not occur, the mortality is less
 - "d) Experiments should be made on animals

The proposal was accepted by the professorial college with a large majority and the commission was appointed immediately, but the government decided, on account of a protest by the Professor of Obstetrics, that investigation by the commission would not be authorized. As a result of this decision, Professor Skoda requested Dr. Semmelweis to carry out the animal experiments himself.

From the circumstance that, in consequence of the decision of the

government following a protest by the Professor of Obstetrics, the investigation by the commission might not take place, the reader will understand the difficulties I had to contend with in my efforts to establish the truth of my views, in order to liberate mankind from such a terrible scourge as childbed fever. Why the Professor of Obstetrics in particular should lodge a protest is not quite understandable, the whole world would not hesitate to blame him for the large mortality, but by these investigations it would have been proven, among other things, that while he does not bear the blame for the large mortality, just as little credit belongs to the staff of the Second Division for their lesser mortality.

At any rate, Scanzoni could not impeach the data which I had cited against the doctrine of epidemic childbed fever, other than to say that it is not new, and he did not even know how to take exception to the data, which the professorial college had presented in support of my views, other than that he declared that animal experiments were worthless.

Therefore, we do not have to support the validity of these data again, because we have sufficiently gone into their value in the proper places in this work

ad a) See Table No. XVII, p 62 and Table No. XXIV, p. 142, and even if the names of the physicians concerned are missing in this table, still the direction is known, and in what single periods it was in effect, and the mortality corresponding to these periods of direction is obvious

ad b) See p 43, line 30 and p 69, line 24

ad c) See p. 123, line 3

In another place in this work, we have today pronounced the animal experiments as superfluous for the demonstration of numerous other arguments, but believe that we have thereby relieved ourselves of the duty to defend them against the impeachment which Scanzoni makes against them

Scanzoni says that Professor Skoda published nine of these experiments, from which however, he could draw no other conclusions than that decomposed animal matter, if it is repeatedly introduced in a liquid form into the genitalia of an animal shortly after delivery, is capable of producing a fatal pyemia

But Scanzoni is not quite satisfied how this result of the experiment can serve as proof that the frequent morbidity (p 338) among the puerperae of the First Obstetrical Clinic is caused by cadaveric infection

We have seen that in the case of Kolletschka, as in many other cases, lymphangitis, phlebitis, peritonitis, pleuritis, etc., etc were caused by the introduction of cadaveric material into his circulation, and since the anatomic findings in Kolletschka and in patients dead of puerperal fever are identical, then we assume for puerperal fever the same productive cause, the presence of this cause was not difficult to demonstrate on the hands of the examiners, if now, as the result of appropriate measures, whose purpose is to destroy the material causing childbed fever, the mortality, which formerly varied between 237 and 518 deaths per year, is reduced to 45 deaths per year, and under these circumstances it would never do to again examine with unclean hands, in order to have proof for the mortality increased thereby, but if the same thing takes place in the experiments on animals, and since 45 is significantly less than 237 or even 518, so it is thus proven that the decomposed matter, clinging to the hand, which in Vienna comes most often from the cadaver, because the students work chiefly on cadavers, causes the frequent morbidity among the puerperae in the First Obstetrical Clinic If Scanzon is not satisfied, then the cause of this dissatisfaction lies somewhere else than in the lack of clarity in the subject under dis-And if Scanzoni even doubts the existence of the decomposed matter on the examining finger, then we must again flourish before him the success of the chlorine washings, as the rock on which opponents dash themselves to pieces, at the First Obstetrical Clinic we do not have to speak of all of our experiences and those of others, further than to use any other procedures than the destruction, by means of the chlorine washings, of the decomposed matter proven present on the hand by the sense of smell, and we have thereby reduced the mortality, which formerly over a period of six years varied between 237 (p. 339) and 518, in 1848 to 45 deaths, as proof that the decomposed matter is not only present on the hand, but also the cause of puerperal fever For if the mortality during these six years

were caused by epidemic influences, then we would certainly have destroyed the decomposed matter adhering to the hand by the chlorine washings, but could not have thereby decreased the mortality.

In his opposition to the animal experiments, Scanzoni says: If the deleterious matter does adhere to the examining finger, it would never be introduced in such a large quantity, as has been done in the experiments; this is certainly true, but the effect does not indeed depend upon the quantity, if a considerable amount is introduced, only a little will certainly be absorbed and the animals, if they are set free after the injection, tend to expel the injected material, so that assuredly only single atoms are retained, there is no method known to us, by which it is possible to administer a quantity small enough to be invisible, yet recognizable only by the sense of smell into such small animals as rabbits

If Scanzoni says that deleterious matter will not be introduced into the individuals as frequently as in the experiments, then he is in error.

The reader will recall, that we could not explain why all parturients with protracted dilatation periods almost without exception died from puerperal fever, as long as we did not know the true cause of childbed fever, but that the explanation of this fact offered no difficulty as soon as we knew that puerperal fever was caused by absorption of a decomposed material, which clung to the examining hand

(p. 340) If a parturient, because of a protracted stage of dilatation, has spent, for example, three days in the delivery room, she is the object of three general visits, and at every visit, she will be examined by 5 students, i e 30 examinations, not counting the many examinations which she undergoes between times How many out of these 30 examining fingers are polluted with decomposed material? Certainly more than one So it happens that, on account of the anatomical structure of the female genital organs in human beings and in animals, infection in the human female occurs more easily than in animals, because in the human female the place where under normal conditions the absorption

occurs, namely the internal surface of the uterus, which, due to the pregnancy is thrown off, is more accessible, while in animals the pregnancy takes place in the uterine horns; but the uterine horns open at a right angle by means of a papillary projection into the uterine cavity, whereby it is impossible to bring the decomposed matter in contact with the area where the conditions for absorption are the most favorable. The injected material, in such small rabbits, reaches the vagina, perhaps the uterine cavity, but certainly not the uterine horns where absorption occurs most easily. This explains why in animals decomposed matter must be repeatedly injected until the infection takes place, while in the human female decomposed matter could be repeatedly introduced, but under suitable conditions perhaps a single injection is sufficient to cause an infection

Scanzoni says: "The examinations of parturients occur as a rule before delivery, consequently at a time when the injuries to the genital organs through which the infection may enter, (p 341) have not yet occurred, and Dr Semmelweis has entirely neglected to introduce the deleterious matter used for the experiments, before the cast into the genital organs of the rabbits used by him, which, in any case, should occur, in order to produce a situation analogous to those taking place in the lying-in hospital " Scanzoni has again proved by his objection that he is in error as to the place, where the decomposed matter could be absorbed, and the time, when it would be absorbed If we have wholly neglected to introduce the deleterious matter into the rabbits before the cast, one cannot cover every aspect of the subject in nine experiments, and the question has only to do with the fact, whether injected deleterious matter brings on the same process in animals as is observed in human puerperae, and there is certainly more of an analogy between recently delivered rabbits into which deleterious matter is introduced after a recent cast, and a parturient who is infected in the lying-in hospital, than between the same parturient and an anatomist, who is wounded during an autopsy, or a surgeon, who is wounded during an operation, and yet, despite this deficient analogy, I hold the unshakeable conviction that the anatomist, the surgeon and the parturient become ill as a result of the same cause and die of the same disease

Scanzoni says "Moreover, we certainly cannot declare ourselves to be in agreement with Professor Skoda, when he regards puerperal fever as identical with pyemia. This opinion of his shall be refuted very soon from another quarter, and for this reason, we do not consider it necessary to go any further into this subject here, so much the more since Professor Skoda has failed to prove statistically that puerperal fever in the majority of cases actually is identical with pyemia. Since this has not been done, as far as the inquiry into the cause of the frequent morbidity among the puerperae is concerned, (p. 342) it is of no value to know, that the injection of deleterious matter into the vagina may cause pyemia,—knowledge which incidentally did not require the experiments of Dr. Semmelweis, so highly valued by Professor Skoda, as proof."

Every case of childbed fever, no single case excepted, is pyemia in the sense that in every case of childbed fever a decomposed matter is absorbed, and this absorbed matter causes a disintegration of the blood, and in rare cases, the pyemia may indeed be fatal in this stage, but as a rule forms exudations from the disintegrated blood The reader will recall, that we discovered the true cause of childbed fever from the fact that the post-mortem findings in the case of Kolletschka were identical with the findings in the puerperae The cause of the disease in Kolletschka was decomposed matter, the same decomposed matter we find on the hands of the examiners and it was introduced into him by a knife, while into the patients in the lying-in hospital, in the majority of cases, it is introduced by the examining finger, by the destruction of the decomposed matter the disease becomes much less common As a result of these findings, we do not regard puerperal fever as a disease, which occurs in puerperal women alone, but on the whole in any case, where a decomposed matter may be absorbed.

And even if puerperal fever is not yet generally recognized as pyemia in the sense which we have indicated, yet in the case of pyemia, which occurs outside the puerperal state, there is

coming to the fore a belief, that in the case of pyemia is to be understood an absorbed-decomposed matter, which disintegrates the blood, and the disintegrated blood in turn forms exudates. The time which Scanzoni has been looking for, when Skoda's views will be refuted, has not yet come

(p 343) Certainly in the sense in which Scanzoni considers pyemia among the puerperae in his *Textbook of Obstetrics*, only the minority of puerperal fever cases are pyemic, but we have already pointed out that Scanzoni has set up an erroneous and thoroughly worthless classification of puerperal inflammation, because to him the nature of puerperal fever is a *terra incognita*

We can show Scanzoni by statistics, that not only in the majority of cases, but in all cases, puerperal fever is a pyemia in the sense which we have described it

At the First Obstetrical Clinic in Vienna in 1841 there died 192 puerperae, in 1845 196, in 1844 215, in 1843 229, in 1846 414, in 1842 463 more than in 1848, and these 1709 dead puerperae were plain cases of pyemia, according to our conception, that in this condition the absorption of decomposed matter occurs with its accompanying consequences, and even the 45 deaths in 1848 were due to pyemia, as we have already pointed out, that it was impossible for us to prevent all cases of infection from without, and that in the cases where no decomposed matter was introduced from without, it was produced within the patient, was absorbed and caused pyemia according to our conception of it

After we have proven statistically, that not only the majority but all cases of childbed fever are cases of pyemia according to our conception, we are justified in repeating our statement that, in reference to the discovery of the cause of the frequent morbidity among the puerperae, it is of great value to know that the injection of deleterious material into the vagina is capable of causing pyemia

Scanzoni says: "There is moreover one point, on which we share Professor Skoda's viewpoint completely, and it is, (p 344) that more extensive and much modified experiments upon animals must be undertaken. That we are fully convinced on this point is evident from the fact, that in March of the past year,

just at the time when Dr Semmelweis began his experiments, we urgently requested from a High Bohemian State Government permission to undertake manifold experiments, carried on with the necessary circumspection on animals in order to banish to some extent the darkness hovering over the manner of origin of the endemic puerperal fever now and then appearing in the lying-in hospital, and to convince everybody how close this lay to our heart, here is our petition verbatim."

The reader will recall that Scanzoni permitted to go undisputed, arguments which Skoda raised against the doctrine of epidemic childbed fever, and the arguments which Skoda enumerated for my views on the origin of childbed fever, and he denied only the conclusiveness of the animal experiments on animals, now all at once to our astonishment he says that he agreed with Skoda only on one point, namely, that the so-worthless experiments on animals must be carried out and that he himself would make the manifold experiments on animals with the necessary circumspection. Such conduct is characteristic only of one whose dogmatic temperament is more precious to him than the truth.

And if Scanzoni moreover speaks of the darkness which surrounds the puerperal fever endemics, which now and then appear in the lying-in hospitals, he thereby proves that he disagrees entirely with every argument presented by Skoda, and later on he says that he does not agree with him, without however giving any reasons

Since Scanzoni disdains to learn from us, we shall undertake to criticize the way and manner in which he attempts to explain the obscurity surrounding the puerperal endemics (p. 345) To that end we quote Scanzoni's petition to the Bohemian State Government

"The High Imperial and Royal State-government!
"In connection with the repeated occurrence of virulent childbed fever in the Prague Imperial and Royal Lying-in Hospital, the answer to the question, how is it possible to prevent the violent outbreak of this disease, which is the heart-felt desire of every philanthropic physician and of mankind in general, would seem to require of a High State-government that every manifestly suitable means be applied to the solution of this problem so highly important for the welfare of humanity, and that no expedient be neglected in the investigation of this fearful yet mysterious disease

"Your respectful petitioner, during his more than five years' service in the Prague Hospital, has become convinced that all measures, instituted in the present era and even in the past for the purpose of searching more deeply into the nature of this disease, have completely failed in their purpose, and he, with an intimate acquaintance with the objective appearance of this disease, as a member of the investigating commission, which met on the 28th of last month in the Imperial and Royal Lying-in Hospital, dares to submit most humbly to the Imperial and Royal State-government for their approval the measure, which appears to him as most suitable for the establishment of the nature of the disease

"The practical accomplishment of this seems all the more urgent, as the reproach might be cast upon the Prague Royal and Imperial Hospital and thereby indirectly to a High Imperial and Royal State-government both here and elsewhere of remaining wholly inactive in the face of such numerous cases of illness and deaths in the Lying-in Hospital and of making no energetic attempt to cast a brighter light on the nature and mode of origin of this malignant disease

"But since the problem first of all is to establish (p 346) positively, whether an influence merely epidemic, based on cosmic and telluric conditions or a miasmatic influence underlies the extremely frequent intensively and extensively violent appearances of puerperal fever in the lying-in hospital, which is dependent upon the aggregation of many gravidae, parturients and puerperae, or whether the disease is spread through its own contagium, or through an infection, thus it seems to your respectful petitioner that the following course is most suitable for answering the question

"I First, a commission of physicians might be appointed, which at least for an entire year according to a previously developed plan, would strictly examine the manner of origin of

puerperal fever within and without the lying-in hospital. It would be desirable in this connection, if the members of these commissions would be chosed by a free election from among the honorable medical faculty, so that the results of this investigation might be considered as the expression of trustworthy men chosed by a learned corporation and thus by their credibility and evident efficiency must win over the medical and lay public "2 The morbidity and mortality ratio among the women

- "2 The morbidity and mortality ratio among the women delivered during the same period outside the hospital in the city might be investigated, for which purpose all official and private physicians in Prague should be instructed to make suitable reports to the district authorities, just as is required for any disease appearing in epidemic form, and to this report a short history of the disease and of the labor should be added with particular consideration of the causative factors.
- "3 For the answer to the question, whether an infection underlies the propagation and extension of the disease, experiments might be undertaken on newly delivered female animals (rabbits, dogs, cats, cows), and part of these animals could be lodged individually in the wards afflicted by puerperal fever, yes, even in the beds, and part of them could be exposed to the action of the deleterious matter by the injection of the different puerperal excretions (lochia, blood, pus) into the genital organs, or by inoculation of the same. In the opinion of your respectful petitioner, only such unbiased and openly conducted experiments could have conclusive effect, and strange to say, this borderline subject has not been mentioned up to now from any quarter.

"Since the accomplishment of these proposals does not offer any particular difficulty and any physician should be pleased to show himself prepared to undertake the solution of this highly important and interesting controversial matter, and if no theoretic objection can be raised against the measures recommended, to the undersigned it appears obligatory to insist all the more upon the practical performance of this investigation, for, if the disease actually were contagious, all lying-in hospitals must be considered as actual murder-dens supported by the state But if puerperal fever is shown to be non-contagious, as appears more

than probable to your respectful petitioner, the influence of cosmic and telluric conditions as causative factors appears much more certain, and thus a High Imperial and Royal State-government will acquit itself of any reproach whatsoever, which may be cast on it, even indirectly and from so many sides because of the maintenance of the lying-in hospitals; but the undersigned is firmly convinced, whatever the result of the investigation may be, that the High Imperial and Royal State-government and the commission appointed by it will render an immortal service to mankind and to science by the solution of such an important problem

Prague, March 29, 1849 Dr. Scanzoni m.p."

From this petition we learn that I had stated the truth, when I said that the Prague Lying-in Hospital must have seen sorrowful times, such as the fifteen months covered in Scanzoni's report, for a mortality not greater than one percent, such as we had at the same time as a result of the chlorine washings in Vienna, does not call for language such as Scanzoni uses

From this petition we learn that Scanzoni's program is incomplete, i.e he wishes to find out whether puerperal fever is of epidemic, miasmatic, contagious or infectious origin. Scanzoni indeed has shown us by an experiment more ingenious than conscientious, that in March and April, 1848, 31 puerperae died fortuitously from puerperal fever, and that in June, July and August, 1848, 19 puerperae died from puerperal fever without any demonstrable cause, and I believe that the etiological factors of the childbed fever, from which 31 women died in two months and 19 in three months, would be important enough to be included in a program dedicated to the discovery of the exciting cause of puerperal fever, it should therefore be stated in the program, finally, it should be discovered when puerperal fever is a fortuitous cause of death and under what conditions there may be demonstrable cause for a lethal childbed fever

This petition proves that I told the truth when I asserted that, in Scanzoni's case, it was not so much a matter of the truth, than of dogmatism, for instead of accepting our discovery, that child-bed fever in every case is the result of infection, and therefore

every childbed fever is an absorption fever, he himself must unfold the secrets of childbed fever, and in order to accomplish this, he follows the same road, rather aimlessly, which we traveled, to which statement he says later that he does not agree

(p. 349) Skoda did not ask the Vienna Professorial College to examine strictly the manner of origin of puerperal fever within and without the hospital, but only placed before them the task of collecting data, and if the commission, which was freely elected from among the Prague Professorial College, after a severe examination of the manner of origin of childbed fever, had said:

Childbed-fever in isolated cases is due to the formation of a decomposed matter in a sick patient, but in the majority of cases it is due to the introduction of decomposed matter into the patient by means of the examining finger, the operating hand, unclean utensils, such as sponges, bed-linen, etc, etc, etc, then the commission would only have stated what I have already proven But if they had said anything else, then they would not have told the truth. If Scanzoni believes that the statement of such a commission would have had persuasive power, then with all respect for the members of the Prague Medical Professorial College, I must protest against such presumption; only the truth has persuasive power, and a medical faculty has such a virtue only when it teaches the truth, and all the medical faculties of the world taken together have no convincing effect on me when they teach error, as I have shown in this book, and I say that all medical faculties of the world teach error, if they do not teach that puerperal fever in all cases is an absorption fever. As for the Prague Medical Faculty in particular, as far as I know only one member shares my views, and that is Professor Jaksch, while Hammernjk, a former member of this faculty and Professor Seyfert, the present Professor of Obstetrics in the clinic for physicians, (p 350) have written against me Professor Streng, the present Professor of Obstetrics in the school for midwives, in his report of the results in his clinic leads the procession of the epidemicists of the world. We shall not fail to consider the views of these opponents

Scanzoni believes that the problem, i.e. the investigation of

the true cause of childbed fever is to be solved by dividing among all the official and private physicians of Prague the task of reporting to the district authorities the cause of the puerperal fever treated in their private practics, Scanzoni assumes therefore that the official and private physicians of Prague knows more about the etiology of childbed fever than he does himself, for certainly if one is not joking, one seeks counsel only from those whom one assumes to have superior knowledge. I must admit that I do not share this view of Scanzoni's I believe rather that the official and private physicians of Prague would report according to the way they were taught in school They would of course have reported that such and such cases have become ill and died as the result of the Genius epidemicus, Mrs N. N became ill of puerperal fever because she left her bed too soon, Mrs N N. became ill because she received too many visitors, etc., etc. school they naturally had never heard of things which merited no consideration in connection with puerperal fever, because their time was devoted to more salutary matters.

The official and private physicians of Prague therefore would never have admitted in their reports, that the midwife was called to the woman who had entertained too many visitors from the house of a sick puerperae, to whom she had been giving douches because of septic endometritis, as for the woman who had eaten improperly, it would have been superfluous to mention that the attending obstetrician had a half hour previously examined a discharging medullary carcinoma of the uterus, (p 351) while, in the case of the woman who had left her bed too soon, it would have been thought unnecessary to state that the accoucheur had been dressing a gangrenous bubo every day in one of his other patients, etc, etc

I am entitled, therefore, to doubt that Scanzoni has not been able to ascertain the true cause of childbed fever from the reports of the official and private physicians of Prague, and has not even been able to learn the true cause of childbed fever from Skoda's discourse, who had indeed mentioned some things not pertaining to puerperal fever

The reader will recall that Scanzoni had also reproached us

for having wholly failed during our animal experiments to inject the deleterious material into the genital organs of the rabbit before the cast, and now he proposes experiments on newly-delivered animals, which however to my regret have not been done up to now, because I am very anxious to know how he would be able to inject the animals with such a minute quantity of the deleterious matter as might adhere to the hand, invisible to the naked eye and recognizable only through the sense of smell, because he has already censured us for having injected a larger quantity. We do not oppose the repeated injection of an invisible quantity of deleterious matter, because we have already pointed out that an invisible quantity of the matter is introduced into the patient repeatedly

But if, as a result of these injections into animals, pyemia results, this bit of information has indeed no value as far as the inquiry into the cause of the frequent morbidity among the puerperae is concerned, because Skoda did not state that puerperal fever in the majority of cases is actually characterized as pyemia And if Scanzoni will take this deleterious matter (lochia, (p. 352) blood, pus) from puerperae, then the contagionists will say that Scanzoni's experiments are superfluous, because we have already known for a long time that puerperal fever is contagious

Scanzoni wants to lodge single animals (rabbits, dogs, cats, cows) in the wards occupied by the puerperal fever patients, yes and what is more, even in their very beds, because only in the wards and beds of the patients, ill with puerperal fever, can one get the disease, either because the atmospheric air, saturated with decomposed matter, penetrates into the uterine cavity, or because the external genitalia, injured during labor, come into contact with decomposed matter in the puerperal beds, so the animals used for the experiments will probably survive the experimentator, since the external genitalia would not be damaged by the cast, and because the atmospheric air could not reach the uterine horns

And if Scanzoni says that the information, that the injection of deleterious matter causes pyemia, did not require for proof Dr. Semmelweis' experiments, so highly exteemed by Prof

Skoda, and if he says of these experiments, that only such unbiased and publicly conducted experiments carry the power of conviction, and that it seems peculiar, that such a closely related subject had not been mentioned by anyone else, then he proves more strikingly than it would be possible for his bitterest enemy, that he prefers dogmatism to the truth

Scanzoni says that if it should be proven by the performance of the measures proposed by him that puerperal fever is contagious, then all lying-in hospitals supported by the state are true murder-dens, Scanzoni has herewith spoken a word, true indeed but shocking

Scanzoni says, to be sure, before the performance of the measures proposed by him, that it seems more than probable that puerperal fever is not contagious, (p 353) but rather due to cosmic-telluric influences, and therefore the devastations of puerperal fever are an unavoidable misfortune, for which nobody can be held responsible, but in this connection he has wholly forgotten that in his program he has also put the question. Is childbed fever of miasmatic origin? Or does childbed fever even develop through infection?

Childbed fever is not of miasmatic origin, but is due to infection, and therefore preventable, and for its devastations he is responsible who does not prevent these devastations. That childbed fever is a preventable disease, I have proven by the decrease of the disease in the First Obstetrical Clinic at Vienna in 1847, in order to make this conviction general, I am publishing the present work, and if Scanzoni in 1849 still opposes my doctrine that childbed fever is preventable, then he puts himself in the ranks of those culpable persons, who hinder progress towards the time when lying-in hospitals may truly cease to be murder-dens

A trivial excuse for Scanzoni's unwitting utterance of such a fatal judgement on himself, lies in his own truly culpable ignorance of the origin of childbed fever, and I, who before I knew puerperal fever to be a preventable disease, had done everything in my power to decrease the number of cases of childbed fever, did not dare to call the lying-in hospitals by those appallingly correct

names. I have only said that the endless series of puerperal epidemics, as such are referred to in the medical literature, were purely preventable cases of infection from without, and Scanzoni, who should have done his part in decreasing their number, in order that the lying-in hospitals might cease being true murderdens, with ignorant (p 354) levity uses such a horrible expression, which impeaches himself to a high degree. And if Scanzoni says, that a High Imperial and Royal State-government and the medical commission appointed by it would render an undying service to humanity and to science by the solution of such a highly important problem, then, since the medical commission appointed by the High Imperial and Royal State-government has failed to solve this highly important problem, we demand every credit, setting aside all modesty, for reasons already stated, because we have solved this problem, as the present work demonstrates, and will leave it to the present and the years to come to decide what merit Scanzoni has acquired for himself by his opposition to my doctrine.

Finally, Scanzoni says, that by July 20, 1849, permission to undertake the animal experiments was obtained from the Imperial and Royal State-government, and he would have immediately begun the experiments, but Professor Jungman, who also was attached to the hospital staff, expressed the opinion that the animal experiments should be carried on at the time of an epidemic and in that way every credit would be taken in advance from the stiff-necked epidemicists. Carl Braun, for example, would smile pityingly at such experiments and say: You have injected the decomposed matter into these animals excellently, yet the epidemic influences, which raged in the lying-in hospitals, and not the decomposed matter, killed these animals also. We made our experiments at a time when no epidemic existed in the Vienna Lying-in Hospital

Scanzoni, therefore, on February 4, 1850 and probably because at that time an epidemic was raging in the Prague Lying-in Hospital, only received the order and the authorization to undertake animal experiments, but his hope, that he would soon be placed in the position to publish the results of these experiments, was

not fulfilled, (p 355) because we live in the year 1859 and the results of these experiments have not yet been published.

A resume of Scanzoni's opposition to my doctrine accordingly shows that he ignores the reasons which we have put forward against the theory of epidemic childbed fever and in favor of our doctrine, he even enumerates them and then lets them go undisputed But my arguments against the doctrine of epidemic childbed fever and the doctrine of epidemic childbed fever could not both be wrong at the same time, we consider our arguments as true and the doctrine of epidemic childbed fever as a dangerous error, and since Scanzoni has failed to prove the contrary, we still hold fast to our conviction.

Scanzoni has not shown even to the slightest extent that our arguments for our doctrine are false, consequently we hold fast to the doctrine, which we have built up on these arguments

Only the argument which we have based upon the animal experiments, has he disputed, but at the same time he has contradicted himself, because he himself has never undertaken such experiments, but has only proposed to do so, and to be sure, in a manner the defects of which we have pointed out

Even the highly important fact of the decrease in childbed fever at the First Obstetrical Clinic in Vienna he has not doubted, but believes he has not observed the same results in the Prague Clinic, but we have shown that even in Prague childbed fever is rarer than formerly, and if Scanzoni does not obtain perfect results, we have pointed out that he has altogether too slight a knowledge of the most important points of our doctrine to be able to avoid all the blunders which would defeat the attainment of perfect results

And if Scanzoni allows the Prague Commission to follow another path in order to attain the truth, (p 356) than that which was indicated to the Vienna Commission, then our doubts about the suitability of this method is justified, since the Prague Commission has not yet found the truth along this path in the year 1859, for which we answer in this work

We believe we speak only the truth therefore, when we maintain that Scanzoni's opposition has left our doctrine unshattered

We shall now make the counter-test, and see whether the traditional folly, which up to now has been called the etiology of childbed fever and which Scanzoni ruminates in both editions of his textbook, will resist our attack, or may be upset like a house of cards.

First, we come upon the erroneous classification of the inflammations in the puerperium, which Scanzoni has copied from earlier authors, because to him also the nature of puerperal fever is unknown. We have shown by the success of the chlorine washings, that even the inflammations in the puerperium, which Scanzoni will not recognize as puerperal fever, are due to the absorption of decomposed matter, and are therefore genuine childbed fever, because we have also prevented these cases by the chlorine washings. With this same fact we can throw aside the whole etiology of the puerperal inflammations, which are not puerperal fever, for were these inflammations based upon those etiologic factors which Scanzoni claims for them, they would not be prevented by the chlorine washings, because only such childbed fever can be prevented, which is due to the absorption of a decomposed matter, but the efficacy of that etiologic factor to which Scanzoni ascribes these inflammations, cannot be restricted by the chlorine washings. Among the other etiologic (p 357) factors for these inflammations, Scanzoni believes the trauma of labor must be blamed in particular, and indeed he also calls these inflammations traumatic. How can the trauma of labor be made harmless by the application of the chlorine washings to the hands?

In order to avoid any misunderstanding, it is necessary to repeat some things, which we have said concerning the etiologic factors for the childbed fever, which is due to auto-infection.

We have said. If trauma be inflicted upon a patient, either by a prolonged stage of expulsion, or by an operation, then parts of the genital organs as a result of the contusions can become necrotic, and consequently a deleterious matter is produced, which, if absorbed, produces childbed fever by auto-infection; we have stated that decidual-placental remnants and bloodclots can remain behind in the uterine cavity, which can pro-

duce the deleterious matter by their putrefaction which causes childbed fever by auto-infection, the first is the absorption of the decomposed matter, the second is the blood disintegration, and the third are the exudates, but this occurs, as we have already pointed out, if it does occur, not once in a hundred cases, and this theory is quite different from Scanzoni's theory, which assumes that the trauma, the decomposed decidual-placental remnants, the decomposed blood-clots produce a local inflammation, which then, of course, can turn into actual puerperal fever, in that the products of the local inflammation are absorbed, with Scanzoni therefore the first is the local inflammation, which need go no further, and for the second, the products of the local inflammation are absorbed, which absorption causes the blooddisintegration, and from this follows the new exudations, (p. 358) in the Prague Lying-in Hospital he has observed hundreds of such cases merely from endometritis

But since we have shown that these hundreds of local inflammations can be prevented, it is thus proven that these hundreds of inflammations are also produced by the absorption of a decomposed matter

Now we will pass over to the etiology of the actual puerperal fever of Scanzoni, who says. "When Kiwisch says to the effect, that the puerperal state of the woman is to be considered as the first necessary condition for the production of puerperal fever, then certainly no one will agree with him, who has had the opportunity to accumulate extended experience and observation of this condition"

The reader knows that we proved in 1847 that childbed fever is preventable, and hence whoever has not prevented the devastations of childbed fever since 1847 is responsible for them

In 1853, Scanzoni further boasted of an extensive experience with childbed fever, as Kiwisch himself has also done. He has therefore read all that appeared up to 1853 in favor of my doctrine of the origin of childbed fever with so little understanding, that he does not once suspect what sort of a judgement he brings down upon himself, when he boasts of such an extensive experience in 1853

We agree with Scanzoni, when in opposition to Kiwisch he declares that the puerperal state is not the first necessary requirement for the origin of puerperal fever, but we do not share his view, when he maintains the actual predisposing cause to be the composition of the blood peculiar to the gravida

his view, when he maintains the actual predisposing cause to be the composition of the blood peculiar to the gravida

(p 359) That the puerperal state of the woman is not the first necessary requirement for the production of puerperal fever, does not, as Scanzoni correctly remarks, proceed from the fact that puerperal fever may not only begin during labor, but even during pregnancy and can even then be fatal; (—the first postmortem Caesarean section that I did was on a patient who died from puerperal fever during pregnancy) but also from the fact that we see the disease which we call puerperal fever, which is caused by the absorption of a deleterious matter, occur even in persons who do not have even the remotest connection with the puerperal state, the anatomist and the surgeon who operates in the surgical department upon male and female patients, are not in the puerperal state, and yet may fall ill of the same disease, when a deleterious substance is absorbed by them

That Scanzoni does not state the truth when he delcares that the composition of the blood peculiar to pregnancy is the actual predisposing cause of childbed fever, we can prove adequately with two arguments out of many, i.e. if such a thing were so, then puerperal fever could not be decreased by washing the hands with chlorine water, because it is not apparent how the chlorine washings should be able to change the composition of the blood peculiar to pregnancy, the peculiar state of the blood during pregnancy, as a physiologic state, is not changed by the chlorine washings, but the destruction of the deleterious matter by the chlorine washings prevents the disintegration of the blood, which would occur if the deleterious matter were absorbed. And just as little as the anatomist and the operating surgeon are in the puerperal state, just as little do they have the composition of the blood peculiar to pregnancy

(p 360) The actual predisposing cause of childbed fever includes everyting that prepares an absorbing surface for the ab-

sorption of a deleterious matter

Pregnancy certainly may be a cause, but not on account of the composition of the blood peculiar to pregnancy, but because, during pregnancy, the internal surface of the uterus is deprived of its mucous membrane, and thereby an absorbing surface is prepared for the absorption of deleterious matter, here belongs also faulty protection of the perineum, for an absorbing surface is formed as a result of a perineal laceration, here belong also the puncture-wound of the anatomist and the surgeon, as also the wound-surface formed during an operation, etc, etc

Scanzoni now turns to the etiology of childbed fever and says, that the epidemic appearance of childbed fever is to be considered before all else, and in order to prove that it can also have an epidemic origin, he appeals to the history of puerperal fever, which informs us that at certain times puerperal fever occurs with a greater or lesser geographic extension. If Scanzoni appeals to the history of puerperal fever in order to prove that puerperal fever is of epidemic origin, we can assume that Scanzoni has either never read a history of puerperal fever, or if he has read one, that he has read it with the same understanding with which he has or has not read the literature up to 1853 favorable to our doctrine.

The history of puerperal fever proves on the contrary, that it is particularly associated with lying-in hospitals and has never flourished outside lying-in hospitals to the extent that it has within, it does, however, flare up (p. 361) from time to time outside the lying-in hospital to a greater extent than usual under the circumstances, but the physicians and midwives, who expand their activities by geographic extension, were sent out into practice up to 1847 ignorant of the cause of childbed fever, is it therefore surprising, that in their ignorance they might bring down devastations among the puerperae by geographic extension?

If the greater mortality among the puerperae within and without the lying-in hospitals were brought about by epidemic influences, then these increased mortalities must always occur at the same time and to the same extent, because the puerperae affected could only be subjected to the same cosmic-telluric influences and not to different ones However, all patients within

and without the hospital might not be infected at the same time and for that reason non-infected puerperae outside may enjoy good health, while the infected puerperae within the hospitals were decimated by childbed fever, on the other hand, the puer-perae in the hospital might not be infected at a time when those outside were, with the contrary result of healthy puerperae inside the hospitals and those outside succumbing to childbed fever. If infection occurred within and without the hospitals at the same time, then puerperae died within and without the hospitals in greater numbers, but since more frequent opportunities were offered inside the hospitals to contaminate the objects which come in contact with the genitals of the patients, this explains why an unfavorable state of health prevails among the puerperae in the hospitals. (p 362) Should an object, which within and without the hospitals is brought into contact with the genitals of the patient, be contaminated with deleterious matter, then this object can infect fewer patients outside the hospital than the same object would have infected within the hospital, because outside there is never the opportunity to bring the contaminated object into contact with the genitals of so many individuals as is offered in the lying-in hospitals, and thus is it explained why puerperal fever never occurs outside the hospital to the same extent as within. To be sure, we have already stated, but we do not consider it superfluous to repeat, that when the puerperae die in great numbers simultaneously in two lying-in hospitals, which lie at a great distance from one another, these patients die because they were infected at the same time and not because an atmospheric-cosmic-telluric influence prevails over such a great geographic area, while the two hospitals, separated by a great distance, are affected, the puerperae among the population living in between are in good health, not only do the puerperae of the population in between enjoy good health, but even the puer-perae of the city in which the affected hospital is situated remain in good health, for, as is well known, puerperal fever can be suppressed in the lying-in hospital by closing the hospital and allowing the patients to be delivered in various parts of the city, yet the atmospheric influence, which affects the two widelyseparated hospitals at the same time, does not extend even to the neighborhood of the lying-in hospital, this procedure is useful, because instruction stops, as also do the (p 363) examinations by the students, whose hands are very frequently contaminated by decomposed matter as a result of their devious medical activities

If the great mortality within and without the lying-in hospitals is due to atmospheric influences, then childbed fever would be an unpreventable disease, but in 1847 I had already proven that it is preventable, and in order to make this conviction a general one, I have published the present work

Unfortunately, says Scanzoni, the investigations made for the purpose of more closely studying these atmospheric, telluric and cosmic conditions, have attained no positive result up to now, naturally what does not exist cannot be studied, because in all seasons of the year, in different climates and under all sorts of atmospheric conditions, puerperal epidemics will be observed, and why not indeed, for in all seasons of the year, in the different climates and under all sorts of atmospheric conditions, infection can occur, and thereby a so-called puerperal epidemic can be produced And if Scanzoni says that our entire knowledge of this subject can be limited to the fact that such epidemics appear more frequently and more virulently in the winter months than in the summer, and that an epidemic raging during the winter not uncommonly stops suddenly with the appearance of the warm season, then the observation of these facts is quite The explanation lies in the circumstance that winter is the time of the greatest activity for the students, while with the beginning of warm weather the excursions into the country To him who will not believe that only the kind of occupation of those who visit the hospital may be the cause of this fact, and who, therefore, believe that the winter as such is the cause of the great mortality, we must ask for an explanation of the fact that at the First Obstetrical Clinic in Vienna there died 2% of the puerperae in October, 2% in November, 1% in December, 2% in January, less than 1% in February and none in March, while in April 18%, in May 13%, in June 10%, in

July 20%, in August 25% and in September 18% of the puerperae died (See Table XIX, p. 120) We ask how the harmful influence of the winter could be mitigated by the chlorine washings, since we had no epidemic puerperal fever through several winters as a result of the chlorine washings?

We ask him: have there been no winters in Vienna for 25 years, in London and Dublin for 124 years? In Vienna over a period of 25 years less than one out of one hundred puerperae died, in the six lying-in hospitals in London and Dublin over a period of 19 years no puerperae have died and over a period of 105 years less than one out of 100 puerperae has died.

If Scanzoni believes that stormy, cold and damp days favor the more frequent and intensive appearance of childbed fever, and if as proof therefor he cites the fact that frequently all women delivered in a lying-in hospital become ill on a particular day, then we do not believe in the harmful effect of a stormy, cold and damp day, but on the contrary are convinced that these women, who became ill of puerperal fever after delivery on some particular day, were infected That such is the case is proven by the fact that the disease among these women can be prevented by chlorine washings, despite the stormy, cold and damp days, and certainly no one will believe that in Vienna over a period of 25 years and in London and Dublin throughout 124 years there were no stormy, cold and damp days, because during these years in these lying-in hospitals the mortality was so small that the disease could certainly only have been very rare If Scanzoni had been exacting in his observations, he would undoubtedly (p. 365) have noticed that this same fact could have been repeated on days when there could have been no complaint of stormy, cold and damp weather

We have discussed this fact under the title of "falling sick in rows," and the reader may refer to this on p 47, line 4 and p. 70, line 11

Scanzoni says the epidemic influence so certainly manifests itself not only in the number, but also in the sort of illnesses, that in many epidemics all show the characteristics of hyperinosis, in others of pyemia, and in others of blood-dissolution, yes,

even in the localization the epidemic influence manifests itself, in that at a certain time lymphangitis, at another phlebitis, etc., etc., are constant post-mortem findings. According to Scanzoni, all these conditions he has cited leave no doubt that certain influences essentially unknown in our present state of earning constitute one of the most noteworthy causative factors for puerperal fever

What Scanzoni says about the forms of puerperal fever, can certainly be read in many text-books of obstetrics, but not observed in Nature, I am sorry to say, that before 1847 we have also had the opportunity to attend numerous autopsies on puerperae, and we were particularly attentive to the forms under which puerperal fever manifested itself on the autopsy table, because at that time at the Institute of Pathologic Anatomy there was an otherwise excellent Assistant, who would make a prognosis from the pathologic findings, whether the epidemic was just starting, at the acme, or in the stage of decline, whether the epidemic would recur, etc., etc His prognoses naturally were never fulfilled and we completely lost our faith in his prognoses, because, in order to convince (p 366) ourselves whether only certain forms actually occurred according to the stage of the epidemic, as the aforesaid Assistant believed, or did not occur, for a long time we autopsied all deceased puerperae, and since it was shown, that on days on which unfortunately it was possible to examine several puerperal cadavers, forms were found which indicated the beginning, the acme or the decline of the epidemic, and even forms which should indicate a recurrence of the epidemic, we never have observed a consistently recurrent form during an epidemic, and after we had finally discovered the true cause of childbed fever, we found it wholly conceivable that it was not possible to conclude from the results what causes would produce these results

And if Scanzoni even in 1853 admits no doubt of the underlying effect of atmospheric influences in the different forms in which puerperal fever appears, then through a simple observation we can prove that Scanzoni is involved in a criminally dangerous error, because among the puerperae, who died during

a period of six years at the First Obstetrical Clinic, 1709 more than in 1848, there certainly were many such forms in which Scanzoni could distinguish the effect of atmospheric influences, and yet we have prevented this disease, and Scanzoni has had five years in which to consider the results.

If Scanzoni wishes to prove thereby that the atmospheric influences never show their effects in the puerperium only, because puerperal fever occurs even during pregnancy, because during an epidemic extremely sluggish and weak or extraordinarily painful spasmodic contractions with a prolonged labor as a result were frequently observed, because during an epidemic metror-rhagia appears more frequently during and after labor, (p. 367) because the babies belonging to the mothers who later became ill from puerperal fever, frequently perished also while suffering from a symptom-complex, which indicated a blood-disease running a rapid course; then the facts have been correctly observed indeed, but the explanation that this disease was caused by atmospheric influences, is erroneous

It is not the atmospheric influences which stir up this evil, but the absorbed decomposed matter is the cause of it all. The absorbed material can be absorbed during pregnancy, with puerperal fever as a result.

If the decomposed matter is absorbed during pregnancy, or if the labor is protracted, so that the absorbed matter will be absorbed afterwards during labor, or if the labor is not yet completed when the blood disintegration sets in as a result of the absorption of the decomposed matter, then the disintegrated blood has a paralyzing effect upon the uterus of the parturient and from this the resultant tendency to extremely sluggish and weak, or cramp-like and extraordinarily painful contractions with an accompanying protracted labor is usually accompanied by flooding. If the baby is still connected with the mother through the placenta at the time when the disintegration of the blood occurs as a result of the absorption of the decomposed matter, the disintegration of the blood will be communicated to the baby from the mother and they will both die of the same disease. That such is the case is proven by the fact that all these disastrous

things can be prevented by the chlorine washings. Regarding the blood disintegration in the infants, the reader should refer to page 40, line 10 and page 66, line 2 to 69

If Scanzoni includes also the decomposed still-born infants in this affair, he is again in error, every mother without exception, whose infant became ill from blood-disintegration, suffered from puerperal fever, (p 368) and why not, since the disintegration of the blood never occurred independently in the infants, but was always transmitted to the baby by a mother already 1ll? Daily experience teaches us that the decomposed still-born baby may be born to the healthiest of parturients, who moreover remain well during the puerperium, proving that the death of the baby was not caused by a disintegration of the blood in the mother from the absorption of decomposed matter, but was due to some other cause If the absorption of a decomposed matter occurs during pregnancy and cases a disintegration of the mother's blood, and thereby causes the death of the fetus during pregnancy, the pregnancy cannot possibly go on until the fetal body starts to decompose, because the gravida may die during pregnancy, or, as is usually the case, go into premature labor. it would not be conceivable that a mother, whose infant died prematurely from a disintegration of the blood, could pass through labor and the puerperium in perfect health. But it is not to be said that such a mother could not become ill as the result of an infection

And that decomposed still-born infants and those, dead as a result of a blood-disintegration, do not die of the same disease, is also proven by the fact that the number of deaths from blood-disintegration can be decreased by the chlorine-washings, while the number of decomposed still-born infants is not affected by the chlorine-washings

Since we have shown that all that Scanzoni has used as proof of the existence of epidemic influences, individual factors excepted, is superfluous, erroneous and deceptive, we shall pass on to the consideration of the remaining etiologic factors of child-bed fever advanced by Scanzoni

(p 369) Of the personal individuality, Scanzoni speaks as

follows: "While an epidemic rages, the predisposition to disease contingent upon the individuality is not to be considered, there is no protection in age, bodily constitution, or any sort of living conditions, and very often the most healthy, youngest, strongest and most blooming women become ill immediately of this terrible, treacherous and murderous disease."

The attentive reader of this work knows that the essential character of a puerperal fever epidemic lies in the fact that into many individuals a decomposed matter is introduced from without in one way or another, and this decomposed matter is such a fearful poison that individuality is indeed no protection against it.

But epidemics apart, Scanzoni is of the opinion that those women become ill of puerperal fever more easily, who are weak, poorly nourished, subject to penury and want during pregnancy, and living under the influence of depressing mental states, we are convinced that through all these circumstances a decomposed matter is either introduced into the patient from without, or as a result of these conditions a decayed matter originates within the patient herself, and that these conditions are therefore not etiologic factors in the production of puerperal fever. How many of the 3556 puerperae cared for in the First Obstetrical Clinic in 1848 would fit into this description of Scanzoni's, and yet we lost only 45 puerperae that year from puerperal fever.

yet we lost only 45 puerperae that year from puerperal fever. In the Vienna Lying-in Hospital during a period of 25 years, when less than one out of 100 puerperae died, 44,838 patients were cared for, of whom 273 died, in the four London and the two Dublin Lying-in Hospitals in 19 separate years not one out of 4558 puerperae died, and in 105 separate years 762 out of 109,656 patients died. How enormous might have been the number out of the 159,052 patients, to whom Scanzoni's description would have applied, and (p. 370) could the mortality have been limited to 999 deaths, had those circumstances been etiologic factors in the production of childbed fever?

According to Scanzoni, such patients more easily fall ill with puerperal fever who are already suffering during pregnancy from some disease, or are far advanced in a composition of the blood analogous to that found in the different forms of puerperal fever.

here belong the women who enter the puerperium suffering from pneumonia, pleuritis, pericarditis, or acute rheumatism

If Scanzoni believes that, in the inflammatory conditions cited,

there is a composition of the blood analogous to that which occurs in puerperal fever, then this only proves again, that even in the year 1853, he does not yet understand the true nature of puerperal fever, in anatomists, surgeons, operative cases in the surgical department, and the newborn, who die of pyemia, there is an identical disintegration of the blood as in puerperal fever, but not in the inflammatory conditions cited by Scanzoni On the contrary, these inflammations protect the patient against puerperal fever, because for humanitarian reasons these women are not used for teaching purposes, and as a result are not infected. And if Scanzoni has observed that far-advanced pulmonary tuberculosis protects against puerperal fever, because he has attended hundreds of autopsies on patients dead of puerperal fever without finding a far-advanced case of pulmonary tuberculosis among them on a single occasion, the reason for this is simple, i.e these patients were not used for teaching purposes, consequently were not infected When Scanzoni says puerperal fever seldom appears among women suffering from anemia, dropsy, acute exanthemata, (small-pox, measles, scarlet fever), typhoid fever or scurvy, then again the reason is that such patients are not used for teaching purposes, consequently are not infected, and if Scanzoni has not observed puerperal fever among the inflammatory conditions named by him, (p 371) then he certainly has been a poor observer, which does not surprise us, he has seen so many puerperae die, he has had time for consideration and the opportunity to read much that has been published in favor of my doctrine from 1847 to 1853, and yet all this has not been sufficient to cause him to notice that puerperal fever is not of epidemic origin
The diseases named by Scanzoni, in a word, all grave illnesses

The diseases named by Scanzoni, in a word, all grave illnesses protect the patients against puerperal fever, in the same manner that street-births and premature births protected the patients at the First Obstetrical Clinic, i e the street-births were not used for instruction, because there was nothing more to be learned

from them, and the premature labors were not permitted to be used for teaching, so as to prevent these premature births when possible, and these cases were not infected for reason (See p. 45, line 13 and p 69, line 24).

Grave illnesses therefore protect against puerperal fever, because Humanity forbids the use of such individuals for instruction, and consequently they are not infected, but at the same time, it is not to be asserted that such patients cannot get puerperal fever, if they are exposed to infection

There is an exception only in the case of eclampsia, because these cases are examined repeatedly, in order to determine correctly the time for the acceleration of labor, and in the First Obstetrical Clinic before the introduction of the chlorine washings almost all eclamptics, in whom the fits had stopped, died in the puerperium of childbed fever, and after the introduction of the chlorine washings puerperal fever in eclamptics was a rarity.

We agree with Scanzoni when he considers protracted labor as an etiologic factor in childbed fever, (p 372) but we do not agree with his explanation of its origin. Above all, a distinction must be made as to whether the stage of dilatation or the stage

of expulsion is prolonged.

If the stage of dilatation is prolonged, then the internal absorptive surface of the uterus remains accessible for a longer period of time according to the length of the delay, and it is conceivable that such an individual is more exposed to the danger of infection from without than another, whose internal absorptive surface of the uterus is accessible for only a short time on account of the rapid course of the stage of dilatation.

If, after an infection has already occurred, the labor 18 so protracted that the secondary disintegration of the blood occurs before the separation of the child from the mother by the labor, then the infant is also a victim of the infection (See page 39-43, line 22 and page 66-69, line 3)

But if the expulsive period is prolonged, indeed no infection from without can occur then, because the presenting part of the infant makes the internal absorptive surface of the uterus inaccessible, but the prolonged expulsive stage can contribute to the origin of childbed fever, because, through the long continued pressure, partial necrosis of the soft parts sets in and in this manner the decomposed matter is produced, which, if absorbed, causes puerperal fever

A mother becoming ill in this way cannot infect her child, because the child is separated from the mother by the birth, before the secondary disintegration of the blood occurs

The production of the decomposed matter under such conditions can also be favored by the fact that in such cases one or another operation may be necessary

(p. 373) The prolonged stage of dilatation is uncommonly more dangerous, because under ordinary circumstances, every patient, whose first stage is prolonged, can be infected

The prolonged state of expulsion, and the operations related thereto, are less dangerous, but the reader knows that we include them among the etiologic factors of childbed fever as contributing to auto-infection, and the reader is also aware that all etiologic factors contributing to auto-infection put together do not cause the death of one puerpera out of one hundred

If therefore, in this connection, Scanzoni quotes from Simpson's table, which goes to prove that the maternal mortality increases in direct proportion to the length of labor, then this table does not have the value which it would have had, if it indicated which particular stage of labor had been prolonged. And if Scanzoni believes the dangerous element in prolonged labor lies in the admittedly unknown influence of the birth-act upon the nervous system and indirectly upon the blood, then we can prove that not the nervous system, but a decomposed matter acts upon the blood, because among the 3556 labors which took place in the First Obstetrical Clinic in 1848, God only knows how many were prolonged, and yet we lost only 45 puerperae from puerperal fever. Because in connection with the frequency of protracted labor, it could not have happened if the nervous system and not the decomposed matter acted upon the blood, that out of the already often mentioned 159,052 puerperae only 999 would have died, 1 e 0 62% or only one in 159 211/999

As for the frequency with which prolonged labors occur

throughout the whole world, if the nervous system and not the decomposed matter affects the blood, (p. 374) then puerperal fever would not have remained confined to Middle Europe; and in addition, in all ages the history of puerperal fever could not have shown that puerperal fever, as we ourselves have actually observed, had only attained this frequency since the 17th century.

In all places and at all times, childbed fever has rarely been due to auto-infection following a prolonged expulsive stage, but in an unlimited number of cases, patients have been infected from without during a prolonged stage of dilatation only in Middle Europe and only since the 17th century.

If Scanzoni takes into consideration the traumatic irritation which is due to a prolonged stage of dilatation and to operative interference, then we are in agreement. But we do not believe that these circumstances in particular cause local inflammation, and that puerperal fever occur because the products of the local inflammation cause a disintegration of the blood by absorption. They cause puerperal fever because they are followed by the formation of a decomposed matter which is absorbed, and thereby causes a disintegration of the blood, and then only are the products of inflammation formed.

We agree also with Scanzoni when he says, that the prolonged course of labor could frequently be the result of puerperal fever already present, for the disintegration of the blood could even occur before the expulsion of the infant, so the disintegration of the blood has a paralyzing effect on the uterus and the labor accordingly must be prolonged.

Emotional states neither introduce a decomposed matter from without, nor do they cause it to form within the individual, (p. 375) and are therefore not an etiological factor in childbed fever. Scanzoni says: "Every busy physician makes observations in his practice which must convince him that the state of health in a puerpera is no more readily endangered by any noxious influence, than by a violently stimulating or depressing mental state"

I am also a busy physician, and I also have observed that not only primiparae, but also multiparae are tormented by depressing mental states, particularly by the fear of death towards the end of pregnancy. Yet among the patients entrusted to my

professional care I have observed puerperal fever so seldom in comparison with the frequency of mental affections, that I cannot reasonably assume any connection between the rarer puerperal fever and the more frequent mental affections

If Scanzoni through diligent study of this book will recognize what the true cause of puerperal fever is, then he himself will certainly be alarmed over the enormity of the danger to which he exposes the patients entrusted to the care of his students and midwives, since he sends them out into practice so crassly ignorant of the cause of puerperal fever, and this was also true in 1847 of all institutions for obstetrical training

Under such circumstances, is it to be wondered that patients, suffering from emotional upsets, may also be infected?

Scanzoni says further. "Due to repeated experiences in this connection in the past, there is nothing we fear more than the sudden exposure of a puerpera to a severe fright, fit of anger or grief, for there is no period in life in which the results of such upsets are as easily demonstrable as in the puerperium"

(p 376) "We can cite a considerable number of closely observed cases in which there was no doubt that such an emotional upset was the actual cause of the puerperal disease, which usually came about in the following manner, i.e. immediately after the operation of that noxious agent, a heavy chill set in, the facies were characteristic, and along with a rapid loss of strength all the symptoms of a rapidly-moving dissolution of the blood appeared. The above-named emotional disturbances are particularly to be feared when they affect a puerpera already ill, for in such a case more than under all other circumstances is a lethal disintegration of the blood to be expected."

Scanzoni has already proven himself such a wretched observer, that we cannot accept as true his observation on the etiologic connection between emotional upsets and puerperal fever, and we are rather of the conviction that in a considerable number of cases they were either infected by Scanzoni himself, or by someone else, and that in the interval between the infection and the outbreak of the puerperal fever an emotional upset occurred But when the puerperal fever had already set in, then no emotional upset occurred, and although the emotional upset in time

may have been closer either to the stage of absorption or to the outbreak, yet immediately after the emotional upset there was a chill, etc., etc If Scanzoni were not such a bad observer, he could not indeed believe that a puerpera could fall ill of puerperal fever without a disintegration of the blood, and that only through the onset of a mental affection was the appearance of a lethal blood disintegration to be expected.

We indict decomposed matter as the cause which brings on childbed fever and this decomposed matter will certainly elicit this same disease in men and in women who are not gravidae, (p. 377) parturients, or puerperae. If an emotional upset is such a harmful thing as Scanzoni believes, then we ask why do not mental upsets also produce this same disease in men and women who are not in the puerperal state? But since it is a fact that mental affections do not cause pyemia in men and in women who are not in the puerperal state, will Scanzoni explain to us, in what proportion in the puerperium is the noxious influence of emotional upsets modified to the extent that they cause pyemia in puerperae?

Scanzoni cannot refer to the composition of the blood peculiar to pregnancy or to the puerperium, for we have already shown that the predisposing cause of puerperal fever cannot be found there, and we have shown the predisposing cause of puerperal fever to be an absorptive surface. How then are mental states related to an absorbing surface?

We cannot prove by means of figures that puerperal fever is not produced outside of the lying-in hospitals by mental affections, because there are no such figures at our disposal. But Scanzoni maintains that, among the consequences which mental affections bring with them, they are also etiologic factors for the puerperal fever, which occurs in lying-in hospitals; he believes that in emotional upsets he has found one of the causes responsible for the larger mortality in the First Obstetrical Clinic than in the Second.

Now we can prove by figures that emotional upsets have caused no puerperal fever in the First Obstetrical Clinic, and from this we may be permitted to draw conclusions in regard to the other lying-in hospitals, as (p 378) well as for the puerperal fever, which occurs outside the lying-in hospitals

First of all, it is necessary to quote here the yearly report of both of the Vienna clinics since their foundation

The Vienna Lying-in Hospital was divided into two sections in 1833 and medical students and pupil midwives were assigned in equal numbers to each section for teaching purposes. The mortality in both was as the following table shows

First Division

Year	Births	Deaths	Percent
1833	3737	197	5 29
1834	2657	205	7 71
1835	² 573	143	5 55
1836	2677	200	7 47
1837	2765	251	9 09
1838	2987	91	3 04
1839	2787	151	5 42
1840	2889	267	9 24
	23,066	1,505	6 56

Second Division

1833	353	8	2 26
1834	1744	150	8 60
1835	1682	84	4 99
1836	1670	131	7 84
1837	1784	124	6 99
1838	1779	88	4 94
1839	2010	91	4 52
1840	2073	55	2 65
	13,095	731	5 58

By a governmental decree, from October 10, 1840, all medical students were assigned to the First Division and all pupil midwives to the Second Division The mortality was as follows:

Clinic for Physicians

1841	3036	237	7 80
1842	3287	518	15 75
1843	3060	274	8 95
1844	3157	260	8 23
1845	3492	241	6 90
1846	4010	459	11 44
	20,042	1,989	9 92

Medical Classics

Clinic for Midwives

1841 1842 1843 1844 1845	2442 2659 2739 2956 3241 3754	86 202 164 68 66 105	3 5 ² 7 59 5 98 2 30 2 03 2 79
	17,791	691	3 38

In the middle of May 1847, the chlorine washings were introduced at the clinic for physicians. The mortality was as follows:

First Division

Year	Births	Deaths	Percent
1847	3490	176	5 04
1848	3556	45	1 27
1849	3858	103	2 66
1850	3745	74	1 97
1851	4194	75	1 78
1852	4471	181	4 04
1853	4221	94	2 13
1854	4393	400	9 10
1855	3659	198	5 41
1856	3925	156	3 97
1857	4220	124	2 96
1858	4203	86	2 04
	48,938	1,712	3 57

Total for 26 years Births 91,046, Deaths 5,206, Percent, 571

Second Division

1847	3306	32	0 96
1848	3219	43	1 33
1849	3371	87	2 58
1850	3261	54	1 65
1851	3395	121	3 56
1852	3360	192	5 7 ¹
1853	3480	67	1 92
1854	3396	210	6 18
1855	2938	174	5 92
1856	3070	125	4 07
1857	3795	83	2 18
1858	4179	60	I 43
	40,760	1,248	3 06

Total for 26 years Births 71,646, Deaths 2,660, Percent, 3 71.

The reader is aware of our conviction that all cases of childbed fever, no single case excepted, is caused by the absorption of a decomposed matter, in order to make this conviction general, we are publishing this work

The decomposed matter which causes childbed fever originates either in the sick patients themselves, and these cases we call auto-infection, which are not always preventable, but will occur as long as the human female bears her young.

Auto-infection, however, is so rare that less than one out of 100 puerperae dies from it

Or the decomposed matter is introduced into the patient from without, and the patients can be so infected in unlimited numbers, but the infection can be prevented by suitable precautions

If we now examine the report of both clinics during the twentysix years of their existence, we find that only in the year 1847, cases of (p. 381) auto-infection occurred in the midwives' clinic, because in that year less than one out of 100 puerperae died in the school for midwives, while in other years in both divisions cases of infection from without occurred to a greater or lesser extent So, for example, during the eight years when medical students and pupil-midwives were equally divided between the two divisions, in the First Division 23,066 puerperae were cared for, of whom 1505 died, and although we are convinced, that as a result of auto-infection less than one of 100 puerperae died, yet we assume merely for easier reckoning that one out of 100 puerperae died as a result of auto-infection. Therefore, on this basis, there died, out of the 23,066 puerperae cared for, 230 from autoinfection and 1275 as a result of infection from without same period, 13,095 puerperae were cared for in the Second Division, out of 731 deaths, 130 died from auto-infection and 601 from infection from without During the six years when the First Division was for physicians only and no chlorine washings were used, 20,042 puerperae were cared for in the First Division, out of 1989 deaths, 200 died from auto-infection and 1789 as a result of infection from without During this same period, there died in the midwives' division, 691 out of 17,791 puerperae, with 177 from auto-infection and 514 from infection from without In the twelve years after the introduction of the chlorine washings, in the clinic for physicians there died 1712 out of 47,938 puerperae,

479 from auto-infection and 1233 from infection from without During the same period, there died in the midwives' clinic 1248 out of 40,760 puerperae, 407 from auto-infection and 841 as a result of infection from without (p 382) Therefore during the 26 years of its existence, there died in the First Division 5,206 out of 91,046 puerperae, 910 from auto-infection and 4,296 as a result of infection from without For the same period, 2,660 out of 71,646 puerperae died, 716 from auto-infection and 1944 as a result of infection from without

Therefore, in the two divisions during the 26 years of their existence, 162,692 puerperae were cared for, of whom 7,866 died, 1,626 from auto-infection and 6240 as a result of infection from without

Truly, the pen would have slipped from my hand at the thought of such a terrible calamity which had befallen a single lying-in hospital in the short period of 26 years, if strength had not been given to my conviction, that sooner or later such a misfortune would be wiped out as a result of this work of mine

The reader can learn from the tables given above, that the mortality in the two divisions over the period of eight years, when the medical students and pupil-midwives were equally divided between them, was not essentially different, i.e. in the First 656% and in the Second 558%, with the mortality only about 098% greater in the First Division, but during the years 1834, 1836 and 1838 the relative mortality in the Second Division was even greater than in the First

During the six years in which the First Division was devoted to the instruction of medical students only, and before the chlorine washings, the mortality in this division was 9 92%, while in the Second during the same period it amounted to 3 38%, (p 383) and consequently in this period the mortality in the First Division, not counting transfers, was about 6 54% greater than in the Second. In the twelve years after the introduction of the chlorine-washings, the mortality in the First was 3.57% and 3 06% in the Second, i.e. only about 0 51% greater in the First Division, but in 1851 and 1852 the absolute mortality in the midwives division was greater than in the First, and in the years 1848, 1851,

1852, 1855 and 1856 the relative mortality in the Second was greater than in the First

The explanation why in the eight years, during which medical students and pupil midwives were assigned to both divisions, the mortality in the two divisions was not essentially different, and indeed the relative mortality fluctuated between the two, why, in the six years, in which the students were separated according to sex and before the chlorine-washings, in the First Division the mortality in 1846 was continually more than five times and during the six years averaged more than three times as great as in the Second Division; why, in the twelve years after the introduction of the chlorine-washings, the mortality in both divisions was again not essentially different, yet even the absolute and the relative mortalities varied between the two divisions, this explanation is very easily given. The reader knows that there are three sources from which the decomposed matter is derived, which, if introduced into the patient from without, causes childbed fever. So long as medical students and pupilmidwives were divided between the two divisions, the patients in both divisions were infected from all three sources

(p. 384) Therefore, there could be no essential difference in the size of the mortality of the two divisions, since as more or fewer were infected in either division, the relative mortality would vary between them

The reason why the absolute mortality did not also vary between the two divisions during this period lies in the fact that every year an average of 1246 more puerperae were cared for in the First Division, almost twice as many puerperae were cared for in the First Division, than in the Second, and with equal possibility for infection in the two divisions, the absolute mortality must necessarily be greater in the division in which a greater number of patients are exposed to the infection

By the assignment of all medical students to the First Division, the decomposed matter flowed more freely in the clinic for physicians than formerly, while it dried up in part in the clinic for midwives, and hence the decrease in mortality in the Second Division to 2 20% and the increase to 3 36% in the First Division,

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the average increase in number of the puerperae cared for yearly in the clinic for physicians amounted to 375 during this period

In the twelve years after the introduction of the chlorinewashings, the mortality in the First Division decreased about 6 35% and in the Second about 0 32%, and according as the cases of infection from without were more or less strictly prevented in the one or other division, during this period the absolute and relative mortality varied between the two divisions, and the average number of additional puerperae cared for yearly in the clinic for physicians amounted to 598. The reader sees that the happy days at the Vienna Lying-in Hospital for over 25 years, when less than one of 100 puerperae (p 385) died, were not brought back by the introduction of the chlorine-washings, and will not return to this hospital or to any other where similar conditions prevail, until the regulations sought for by me through the Government go into effect, i.e that everyone attending the lying-in hospital be strictly forbidden under pain of expulsion to occupy himself during the period of service in the lying-in hospital with anything which is capable of causing an infection

The reader certainly should believe that I did everything possible to prevent all cases of infection from without and I was not successful, for in 1848, when the chlorine-washings were supervised by me as strictly as possible throughout the whole year, I lost 45 out of 3556 puerperae, which therefore is not acceptable under the proposition that less than one out of 100 puerperae should die of unpreventable infection, still ten cases In 1847, when occurred as a result of infection from without the chlorine-washings were introduced in the middle of May, 176 out of the 3490 puerperae cared for in the clinic for physicians died, 34 certainly as the result of auto-infection and 142 from infection from without.

And although the mortality was decreased about 635%, after my period of service numerous cases of infection from without occurred, this is explained by the fact that all physicians on service in both divisions were and are opponents of my doctrine. My successor as Assistant, Carl Braun, has written against

me and during his five-year Assistancy (1849-1853) there were

20,489 puerperae cared for at the clinic for physicians, of whom 527 died, 204 as the result of unpreventable auto-infection and 323 from a preventable infection from without

(p. 386) In 1858, when Carl Braun began to function as Professor at the clinic for physicians, 4203 puerperae were cared for, of whom 86 died, 42 from auto-infection and 44 from preventable infection without

Gustav Braun, Carl Braun's brother and successor as Assistant, indeed has not raised his voice publicly yet, but the 400 deaths in 1854 proclaim loudly in a stentorian voice, what a hearty epidemicist he is O Michaelis! O Michaelis!

In the four years 1854–1857, in which Gustav Braun served in the clinic for physicians as Assistant and Acting Professor, 16,197 puerperae were cared for, of whom 878 died, 161 from from auto-infection and 717 from a preventable infection from without.

As for the midwives' clinic, the chlorine-washings were never introduced there while I served as Assistant, in a paragraph in Carl Braun's writings against me, it states that after my Assistancy, the chlorine-washings were introduced there, but with what conscientiousness they were applied is shown from the fact that in the last twelve years the mortality decreased only about 0 32%

And indeed quite naturally the physicians of the midwives' school could not possibly learn how to prevent puerperal fever from the physicians of the First Division, for they certainly have shown over a period of six years that they understood the prevention of puerperal fever better than the physicians of the First Division, because over this period they have had a threefold smaller mortality in the school for midwives.

The table given above shows that in both divisions during the 26 years they were side by side there were 20 single years in which the mortality in both divisions was the same, (p 387) and eight years in which the mortality was equally large, and in twelve of these years equally small, and only in six single years was there a glaring difference with the disadvantage on the side of the First Division. We have pointed out that this difference was due to

the fact that the decomposed matter, which came from the cadaveric source, was more abundant at the First Clinic in these six years, because of the assignment of all the medical students to it, than in the Second, and that the preponderance of mortality at the First Clinic in comparison with the Second during these six years was to be sought for in the cadaveric particles, with which the hands of the examiners in the First Clinic were contaminated

Since I have familiarized the reader with the fact, that the preponderance of the mortality in the First Division during these six years in contrast with the Second was due to the cadaveric particles with which the hands of those making examinations were contaminated, we shall return to Scanzoni Scanzoni says. "We cannot refrain from calling attention here to the fact, that a reason for the so frequent and virulent illnesses among the puerperae cared for in the larger lying-in hospitals is perhaps also to be sought in the anxiety and apprehension with which they enter a house, with the reputation of yearly exposing a large contingent of them to a lethal disease"

Thus we are assured from many sources, that in the Vienna Lying-in Hospital, where the admission into the two divisions changed every 24 hours, the gravidae and the parturients early in labor would not present themselves for admission before the hour for admission into the Second Division, in part probably to avoid being used by the students for teaching purposes in the First Division, but more probably for the reason that it was generally known that the state of health among the puerperae (p 388) cared for in the latter was disproportionately unfavorable But if circumstances did not permit them to wait for the desirable time, one can imagine with what emotion, and with what anxiety, the parturient entered the hospital, and one must take into consideration that barely on arrival they must submit themselves for examination and observation to a rather large number of male persons, not always noted for the greatest delicacy of feeling, then one will not attribute to us any absurdity, because of our belief that we have found in this circumstance one of the causes responsible for the undeniable difference in the mortality ratio between the two free divisions cited" Scanzoni has indeed

uttered an absurdity if, in the fear of the patients, he finds one of the causes which is responsible for the increase in mortality in the First Obstetrical Clinic in contrast with the Second, the above table has shown something else again, the patients are indeed afraid of the First Clinic, as we have related in this work, p 32, line 30 But no single individual has died as a result of this fear The Jeremiad, which Scanzoni has voiced against the First Clinic in Vienna, also applies word for word to the clinic for physicians in Prague, and if the Prague Lying-in Hospital has not produced a table, such as we have in our Table No I, it is not because there was not a significantly greater number of deaths at the clinic for physicians in Prague than in the midwives' clinic. Indeed for the reason that in the clinic for physicians more frequent infections occurred from the cadaveric source than in the midwives' school, because, as we have already shown, regular transfers of sick puerperae took place from the clinic for physicians, hence the different state of (p 389) health in the clinics, to the disadvantage of the clinic for physicians, would not be evident

Who would dare to deny that these same causes in Vienna, in Strassburg, do not have the same consequences in Prague as in Vienna and Strassburg?

In the enumeration of the etiologic factors for childbed fever, Scanzoni proceeds to say: "On many sides, diatetic errors, such as cold food, foods difficult of digestion, hot drinks, etc., are regarded as outstanding causes of the puerperal morbidity. We shall in no way deny the possibility of such a manner of origin of puerperal fever, yet the influence of the harmful things cited is certainly only a subordinate one"

We also deny the possibility that puerperal fever can occur as a result of these harmful things, because through them a decomposed matter is neither introduced into the patient from without, nor formed in the patient

Finally says Scanzoni, "We shall indeed examine closely the opinions which prevail in regard to the causes of the exceedingly frequent and virulent appearances of puerperal fever in the lying-in hospitals"

However, before we pass over to these opinions, it might be useful to express here my views on this subject, and for this purpose I urge the reader to picture to himself very distinctly what occurred in the Vienna Lying-in Hospital before the introduction of the chlorine-washings, there there were 42 students, who, because of the system according to which they were being trained as physicians, were sure to contaminate their hands frequently with decomposed matter, and because nobody warned them, they examined with hands reeking with decomposed matter the 10 to 30 patients, who were at their disposal (p 390) in the lying-in hospital as teaching material and since outside the lyingin hospitals there is never any oppotunity to contaminate the hands with decomposed matter with any regularity, and if the hands are contaminated outside the lying-in hospital with decomposed matter, yet there is no opportunity there to examine 10 to 30 patients one after another, and if the reader draws conclusions from the Vienna Lying-in Hospital about the other hospitals in which similar conditions prevail, then the reader has the cause of the comparatively frequent and virulent appearances of puerperal fever in lying-in hospitals.

Scanzoni believes that the comparatively frequent and virulent appearance of puerperal fever in lying-in hospitals is due to a puerperal miasma

In the passage in this work dealing with the puerperal miasma, we have declared that it is true that a decomposed matter can permeate the atmospheric air of the lying-in ward, and that puerperal fever can be caused by the penetration of air so defiled into the uterine cavity, but at the same time we maintained that a puerperal miasma does not exist in the sense accepted up to this time, and we have cited the results of the chlorine-washings as conclusive proof. The chlorine-washings as practiced in the labor-room would be futile, if puerperal fever is caused by a miasma, which developed in the lying-in ward. We have constructed many tables in order to prove that the overcrowding of the lying-in hospital bears no causative relation to the deaths occurring in the same lying-in hospital, and we are justified in believing that these tables also prove that that opinion is false,

which holds that a puerperal miasma must develop as a result of the presence of a certain number of puerperae. And in order not to carry water to the Danube, we shall only refer to the one fact, that in the fifty most unfavorable of the 97 months (p 391) at the First Obstetrical Clinic less puerperae were cared for than in the two most favorable of these 97 months, in which no puerpera died (See Table XXXVI, p 215). This fact gives the danger of overcrowding and the existence of a puerperal miasma the death blow

Over and above all this, we shall refute the arguments which Scanzoni advances for the existence of the puerperal miasma. According to him, the fact, "that in a lying-in hospital unusually frequent cases of illness occur, while the women delivered in the same city and the same neighborhood enjoy a good state of health," speaks for the existence of a puerperal miasma. The reader knows that the cause of this phenomenon lies in the fact, that within and outside of the lying-in hospitals infections do not always occur at the same time, "that the abnormal frequency of the illnesses very often occurs at the time with an all too frequent overcrowding of the lying-in ward." Infections also occur in an overcrowded lying-in hospital "That they were observed particularly in the winter months, when the renovation of the air in the sick-wards met with more difficulty" Because in winter the students are more occupied with things which contaminate their hands with decomposed matter, than in summer, and it would be worth the trouble to overcome the difficulty about the renovation of the air in the sick wards, if this were the cause of such numerous cases of the disease "That only the puerperae located in certain wards became ill " When 15 or 20 patients were infected one after another in the labor-room, then these patients would indeed fill up a lying-in ward, in which they would become ill And if Scanzoni says finally, that a more favorable state of health would be obtained in several places by the occupation of an especially erected, new and spacious house, by the careful supervision of the puerperae and the maintenance of cleanliness of the wards and the different utensils, (p 392) then we are very much in agreement with him, presupposing that Scanzoni counts the examining finger among the utensils to be kept clean, if not, then we believe that puerperal fever will flourish in the new buildings, as we know happened in the case of the Strassburg Lying-in Hospital

If Scanzoni says that hospital gangrene, typhus and dysentery originate from a miasma, and consequently puerperal fever also, because a comparatively large number of women mostly belonging to the poor classes, and are careless as a rule in bodily cleanliness, are lodged in the lying-in ward where the air is befouled with the uninterrupted secretion of the lochia, by the excretions of the mothers and infants, then we shall not participate in any discussion of the origin of hospital gangrene, typhus and dysentery, but we believe that these conditions do not produce a puerperal miasma, because all these conditions were present in the First Division in Vienna in 1848, and yet no puerperal miasma was produced, because we lost only 45 puerperae.

But if Scanzoni says that there can be one or several puerperae already ill in the ward, who by the uninterrupted discharge of an ichorous foul-smelling secretion from the genitals contaminate the air, then we are completely in agreement with him, if he believes that a puerperal fever could be produced thereby in the healthy patients, but we do not believe that puerperal fever so produced is of miasmatic origin

Naturally, says Scanzoni, this morbidity increases with the number of those already ill in a ward, and we know of no conduct more repugnant to common sense, more reprehensible than the designation of special wards by the hospital administration for the reception of sick puerperae, (p 393) where they are crowded in and exposed to the effects of a truly tainted air

We know hospital directors whose conduct was very unreasonable, even reprehensible, and they are the ones to whom Scanzoni refers, who by their unreasonable and even reprehensible opposition to my doctrine made it necessary to house many sick puerperae, while if my doctrine had been observed the rooms set apart for them would have seldom been occupied

At the close of his discussion of the etiology of puerperal fever, Scanzoni says; "From what has been said, it follows that we consider the influence, which so often exerts its murderous power on lying-in hospitals, to be miasmatic, and in this connection, we must however especially emphasize that here also atmospheric or any otherwise manifested influence can not be denied, for which we shall only briefly state that the frequent morbidity in the lying-in hospital often coincides with flourishing puerperal epidemics on the outside, increasing and decreasing along with the latter, and as we have frequently observed, with the occurrence of a sudden change in the weather or other atmospheric changes in the case of otherwise constant local conditions." We do not find the murderous force in lying-in hospitals as Scanzoni does in puerperal miasma, but in decomposed matter. That such is true we can prove by the fact, that we ourselves, not to speak of the experiences of others, have struck against this murderous force in three institutions, not by measures directed against the puerperal miasma, but through measures directed against decomposed matter If Scanzoni considers the murderous force in lying-in hospitals to be due to puerperal miasma, then he marks himself, (p. 394) and all directors in whose hospitals the puerperal miasma develops its murderous power, as criminals, because it should be their most holy duty to prevent the development of the puerperal miasma or to destroy anew the miasma developed in spite of this The lying-in hospitals are true murder-dens supported by the state, not only if puerperal fever is contagious but also if puerperal fever is of miasmatic origin, or if it is due to infection We are of the conviction that puerperal fever never originates otherwise than by infection; due to this conviction, since 1847, we have done all in our power to keep lying-in hospitals from being true murder-dens. And if Scanzoni considers that the murderous force in lying-in hospitals is due to the puerperal miasma, and in spite of this he has not uttered a syllable on how one can prevent the development of this puerperal miasma, or how to destroy it when it has developed, then this shows only the thoughtlessness with which Scanzoni writes of things he does not understand

If by the fact that an epidemic outside the lying-in hospitals often coincides with the frequent morbidity within, Scanzoni

wishes to prove that in addition to the puerperal miasma it runs a somewhat epidemic course, then we do not share this view, and on the contrary explain the frequent morbidity within and without the lying-in hospitals by the fact that the patients within and without the lying-in hospitals are infected simultaneously.

If even Scanzoni will have repeatedly observed that the epidemics within and without the lying-in hospitals have a corresponding increase and decrease, then we cannot comprehend how such an observation is possible, because there certainly have been no statistical reports sent to Scanzoni on childbed fever occurring outside the lying-in hospitals. After all, Scanzoni also believes that he can present proof (p. 395) that along with the miasma there is also something of an epidemic nature involved in puerperal fever, that with a sudden change in the weather or other atmospheric changes, i.e. that the cold winter lets up and with the spring the excursions of the students into the country begin, that in the presence of otherwise permanent conditions the epidemic ceases, that on account of the change in the season of the year the hands contaminated with decomposed matter become less common. Such belief is naturally no consideration of a worthy subject.

The question whether puerperal fever is a contagious disease or not is answered by Scanzoni in the negative, and with this we agree Scanzoni says: "All the reasons which the advocates of the contagiousness of puerperal fever bring forward in favor of their views, are either not proven, or they speak for the existence of a miasmatic or epidemic mode of origin of this disease, or admit after all even the assumption that a deleterious matterpus, ichor, etc,—from a sick puerpera is introduced into the organism of a healthy patient, and thus a general morbid condition of the blood is produced, when certainly no one could speak of an actual contagium."

We have proved that puerperal fever is neither of miasmatic nor of epidemic origin, but in all cases is caused by the absorption of a deleterious matter, and to the sources from which the deleterious matter is derived, belong indeed also puerperae who produce a deleterious matter

Scanzoni says. "As for the last-named manner of origin of

puerperal fever, 1.e the purulent or 1chorous infection of the blood by deleterious matter introduced into the organism, Semmelweis and Skoda have directed the attention of the medical public to this subject by their assertion that the very unfavorable mortality ratio (p 396) in the First Obstetrical Clinic in Vienna is due solely to the circumstance, that the physicians in attendance there work in the dead-house shortly before the examinations of the gravidae and parturients and thus cause the transmission of the different deleterious materials clinging to their hands into the genitals of the patients examined We were the first to doubt the correctness of this assumption and there joined us later, at least on the essential points, Seyfert, Kiwisch, Lumpe and Zipfl, and even in Paris the publication of Semmelweis' discovery by Arneth at the Academy met with no approval. It would be carrying the matter too far for us to set forth all the reasons which are set up against the views of the aforesaid physician, and for that reason we shall content ourselves with reference to the literature on this subject, with the observation that we shall not deny the possibility of such an infection in single cases, but in any event one goes too far, if he believes that he can explain the frequency and the virulence of the puerperal diseases in lyingin hospitals in this one way and only in this way."

Truly it excites all my sympathy, when I see how Scanzoni in his own culpable ignorance and even in 1853 in a wholly naive manner refers to a work in which he opposes my views on the origin and prevention of childbed fever, and in which however he absolves all lying-in hospitals from the charge of being true murder-dens supported by the state, only for the reason that it seems to him more probable that the mortality is caused by cosmic and telluric conditions. But in 1847 we had already shown that all cases of puerperal fever are caused by infection, and therefore are preventable. In order to make this truth generally known, we publish the present work, and if Scanzoni in 1853 is still in opposition, then by his own efforts (p. 397) he places himself in the ranks of the guilty ones, whose opposition is responsible for the fact that, after a period of thirteen years, so few lying-in hospitals have ceased to be true murder-dens

And how Jealous Scanzoni is of the credit for having first op-

posed my doctrine, is shown by the fact that he even names Seyfert among those who later joined with him, although Scanzoni and Seyfert opposed me in a common publication, to be found in the 26th issue of the Prague Quarterly

The time will certainly come when Scanzoni, to put it mildly, will at least regret that it will be impossible to erase this fact from the memory of mankind

Scanzoni will certainly never occupy a place of honor in the history of puerperal fever, not indeed because he opposed me, but because of the way in which he opposed me. Several times we have had some occasion to call the attention of the reader to the fact that Scanzoni in his opposition did not seek the truth, but the purpose of his opposition was always to justify himself, and that it was of little consequence to him to deny the truth in order to attain his object, he would even have been guilty of such a denial of the truth

Scanzoni says that Lumpe and Zipfl had joined him in his views. The fact is in a general meeting of the Imperial and Royal Society of Physicians in Vienna on May 15, 1850, I spoke on my theory of the origin and prevention of childbed fever, and this talk was continued in the general meeting of June 18 and finished in the general meeting of July 15, 1850 (p 398) In this discussion, Lumpe and Zipfl spoke against me, but Chiari, Arneth, Helm and Hayne adhered to my conviction, and Dr. Herzfelder, First Secretary of this society, in his report of the proceedings of the Imperial and Royal Society of Physicians in Vienna for the year 1850, says the following:

"As for general pathology, we encounter here the practical solution, as it seems, of one of the greatest problems of medicine, ie the exciting cause of the hitherto devastating puerperal epidemics, by Dr Semmelweis, according to his opinion, child-bed fever is caused only by the absorption of decomposed organic matter into the blood of the mother, without denying the possibility of its self-development in the body from placental remnants and other possibilities, is introduced from without into the maternal organism by the accoucheur himself, and indeed for the most part comes from cadavers in the state of decomposition For these reasons Dr Semmelweis has imposed upon the ac-

coucheurs the duty of diligent washing with a solution of chloride of lime before every delivery, and by this has been so fortunate as to prevent the further development of more serious epidemics up to this time. Against the manner of origin of the disease as stated, there were found vigorous and honorable opponents in Doctors Zipfl and Lumpe, who preferred to justify the miasmatic origin of this evil by statistical data, however, in the solution of Dr. Semmelweis is found an adequate refutation as well as of Doctors Scanzoni and Seyfert of Prague, so that the concept of the disease as outlined, which finds its warmest supporters in the Doctors Arneth, Chiari and the Acting Director Helm, and also from the veterinary standpoint in Prof. Hayne, can be considered as a real triumph of medical research."

If Scanzoni learns nothing further from these discussions (p 399) than that Lumpe and Zipfl have joined him, then he has once again denied the truth, because the decision would be against him, and by such a disavowal has endangered the lives of many who are not participants in this quarrel. For how many physicians might there be, who seek instruction from Scanzoni alone, assuredly, the humanitarian must tremble for the lives of those who are entrusted to the hands of such deluded men. Such an opposition will certainly be recorded in the history of puerperal fever. We shall return later to Seyfert, Zipfl and the Paris Academy. As for the discussions in the Society of Physicians, the reader may refer to the 2d volume of the 6th year, and both volumes of the 7th year of the Journal of this society.

In spite of Scanzoni, we adhere to our conviction that all cases of puerperal fever, no single case excepted, which have occurred since the human female has borne young are due to the fact, that in rare cases a decomposed matter is formed within the body, and that in the preponderant majority of cases of puerperal fever, a decomposed matter is introduced into the patient from without. We adhere to our conviction that in rare cases puerperal fever will result from the formation of a decomposed matter in the body, as long as the human female bears young

But whether puerperal fever, which is caused by the introduc-

tion of a decomposed matter from without, will cease, or to what extent puerperal fever so caused will occur, depends on whether my doctrine on the prevention of puerperal fever will find a general application in practice, or if it will be followed only to a greater or lesser degree

As proof of the everlasting truth of this doctrine, we present the present work.

(p. 400) If Scanzoni says that he will not deny the possibility of such an infection in single cases, then he is again involved in an error, which indeed does not surprise us any more, for Scanzoni has involved himself in so many errors, that a new one could not surprise us, and in order to show him how to comprehend this new error of his, we shall only call his attention to a single fact. In 1841, there died at the First Clinic in Vienna 237 puerperae from puerperal fever, in 1845 241, in 1844 260, in 1843 274, in 1846 459, in 1842 518. In 1848, with chlorine-washings we destroyed the decomposed matter on which the infection depends, and thus we limited the cases of infection to 45 Did the cases due to infection in the First Clinic occur only in single cases? Is it not permissible to conclude that what happened at the First clinic has happened in the past and will happen in the future?

However, for Scanzoni it is after all a step forward, when he does not deny the possibility of such an infection in single cases. With this we have come to the end of Scanzoni's etiology of puerperal fever, and the reader has seen how badly his etiology has borne our critique, which has shown that, with the exception of some facts which were observed by Scanzoni, and excepting single cases where Scanzoni will not deny an infection, the remainder is error and delusion, and it would be fortunate for the parturient sex, if there were no other etiology for childbed fever than the For no puerpera has ever died from childbed fever as a result of epidemic influences, nor because of her individuality, (p 401) many mothers and infants have died from childbed fever as a result of protracted labors, but never in the way that Scanzoni imagines it, because the nervous system does not cause a disintegration of the blood as a result of a protracted labor, no mother has ever died from childbed fever in consequence of an

emotional upset, dietetric errors, nor from a puerperal miasma, because the puerperal miasma does not exist as Scanzoni conceives it

Tell us for God's sake, Herr Hofrath, what then is the causative factor in the childbed fever, from which so many hundreds of puerperae have died at the Prague Lying-in Hospital, whose post-mortems you yourself have attended? The reader will recall that Scanzoni, by his very ingenious as well as conscientious experiments, which he made in the Prague Lying-in Hospital with the chlorine-washings, has discovered two important etiologic factors for childbed fever, 1 e chance In the months of March and April 1848, it was ascertained that 31 puerperae died fortuitously, and in June, July and August 1848, 19 puerperae died without any demonstrable cause; if therefore these many hundred women, whose post-mortems Scanzoni had the opportunity to attend died in part fortuitously and partly from no demonstrable cause, and if thereby the charge, which I make against the Scanzonian etiology, that as a result of his etiology the puerperae cannot die in large numbers from puerperal fever, is disproved, then the blame for my error is due only to Scanzoni's secretiveness, which prevents him, me and the rest of the world from being able to attain a more exact knowledge of the two highly important etiologic factors for childbed fever discovered by him

(p. 402) In 1847 I made the discovery that puerperal fever is caused by infection In 1850, Scanzoni in the 26th volume of the Prague Quarterly declared my discovery to be an hypothesis. In 1852 Scanzoni in the first edition of his Textbook of Obstetrics says that he would not deny the possibility of such an infection in single cases. In the second edition of his textbook, which appeared in 1853, he still did not deny the possibility of such an infection in single cases.

In 1854 appeared the fourth edition of Kiwisch's Clinical Lectures on the Special Pathology and Therapy of the Diseases of Women, edited and enlarged with additions by Scanzoni For the prophylaxis of childbed fever, there were among other things the following. "Moreover in an institution where any possibility

exists of infection of the parturients and puerperae by decomposed animal matter (cadaveric poison, wound discharges, decomposed puerperal discharges), such an influx is to be prevented with all conscientiousness and for this purpose are to be recommended the chlorine-washings and fumigations used by the English and Dr. Semmelweis"

Although this declaration only takes into consideration the cases of infection from without which occur in lying-in hospitals, and does not include the cases of auto-infection in the lying-in hospitals and of puerperal fever outside the lying-in hospitals, and although all cases of infection from without in the lying-in hospitals cannot be prevented by chlorine-washings and fumigations alone, yet this declaration of opinion by Kiwisch significantly supersedes Scanzoni's view, which admits such an infection in single cases only Since Scanzoni did not oppose this declaration in an additional remark, as he has done on other subjects, when he differed with Kiwisch, (p 403) then from this omission we made the gratifying conclusion that Scanzoni had been converted to our views, and since we supposed that Scanzoni could certainly have been converted only as a result of convincing observations to our view-point, which he had so long opposed, we ardently awaited the appearance of a brochure or an article at least, perhaps in the "Contributions to Obstetrics and Gynecology," in which he would communicate to the medical world his change of conviction along with the conclusive observations But after a year had passed, and the second and the third and fourth, and Scanzoni had still not presented himself to the medical world as a medical Rousseau, naturally then our hopes dwindled more and more with each year, and the fifth year was selected as the one in which we must certainly resign ourselves to our illusions

Towards the end of 1859, there appeared a work with the title, "Historical and Critical Narrative of the Pathology of Childbed fever from the Earliest Times down to our own," by Dr H Silberschmidt, which was awarded a prize by the Medical Faculty of Wurzburg The author declares his opposition to my view of the origin of childbed fever, and because this essay was

awarded a prize by a corporation of which Scanzoni is a member, to whom a decisive influence was permitted in this transaction, so it is more than certain to us that it was an illusion on our part, when we hoped that Scanzoni had been converted to our viewpoint, because he had not disputed Kiwisch's statement in our favor

Yes, this essay did not mention once the single cases in which Scanzoni would not deny such an infection

Still, let us hear what Dr Silberschmidt has to say "Skoda and Semmelweis believe the immediate cause of puerperal fever to be cadaveric poison" Thus again the first sentence (p 404) proves that Dr Silberschmidt presumes to pass judgement on my views which he certainly does not understand. The immediate cause of puerperal fever is a decomposed animal-organic matter, and one of the three sources from which this material is derived, is indeed the cadaver. Because conditions in the First Obstetrical Clinic in Vienna permit the decomposed matter to come from the cadaver more frequently than from the other two sources, likewise in this clinic cadaveric poison was the principal cause, and particularly in the six years in which this clinic was devoted to the instruction of physicians only and the chlorinewashings had not yet been adopted, the preponderance of mortality in contrast with the Second was due entirely to cadaveric poison. In the obstetrical department of the St Rochus Hospital in Pest, the large mortality among the puerperae from the decomposed matter of the surgical division was due to the fact that a surgical chief was at the same time Obstetrical Primarius, and puerperal fever was therefore due to decomposed matter which came from the source represented by the sick patients, whose disease produces decomposed matter The great mortality of the two years at the Pest Obstetrical Clinic was due to the decomposed matter which came from the third source. decomposed matter in the two epidemics in the Prague Lying-in Hospital under Chiari came from two parturients whose genitalia became gangrenous during labor due to disproportion And the decomposed matter for the first epidemic, which the history of puerperal fever recognizes, came from wounded persons

And that this is so, neither I nor Professor Skoda believe, but we know, and this is my own and Skoda's conviction, and if Dr Silberschmidt is capable of a conviction, if he does not write merely on order, if he will allow someone to flatter him, then we recommend to him a profound study of this work and I am convinced that he will come to the same conviction

(p 405) Dr Silberschmidt says. "Skoda and Semmelweis believe that the cadaveric poison is introduced into the organisms of the parturients during examination by the physicians, who a short time previously had performed post-mortem examinations" Dr. Silberschmidt has not proven that this is not so

Dr Silberschmidt says. "To this opinion they add the observation that, in the division assigned to the students for examination, childbed fever has a much more fatal action than in the division for midwives" Dr Silberschmidt has not proven that the mortality in the physicians' division is not greater than in the division for the midwives nor that, by destruction of the decomposed matter, which is present in the physicians' division but not in the school for midwives, the mortality in the physicians' division has not decreased

He has not proven that deleterious matter introduced into wounds does not cause pyemia

He has not proven that chlorine-washings are unsuitable for the prevention of the disease we are discussing, and if he passes over in silence the success with which I managed the chlorine-washings at the First Obstetrical Clinic, and instead cites the futility of the chlorine-washings as observed by Scanzoni in Prague, then he does what so many others of my opponents have done, ie he simply conceals the truth in order to justify himself

As for the futility of the chlorine-washings as observed by Scanzoni, we have shown in the course of this critical examination of Scanzoni that, after the introduction of the chlorine-washings in Vienna, the mortality in Prague was also diminished because the staff of the Prague Lying-in Hospital learned from physicians, who chanced to come to Prague from Vienna, what measures were recommended by Dr Semmelweis (p 406) for the decrease

of puerperal fever, whereby more caution was observed in Prague. But if it was not possible for Scanzoni to limit the cases of infection to those of auto-infection, then we have found the cause thereof in the fact that Scanzoni is ignorant of the most important precepts of my doctrine, and hence his success must naturally be incomplete, and the six months in which Scanzoni experimented unhappily because of the lack of the necessary elementary knowledge, I contrast with the twelve years at the First Obstetrical Clinic, in which the mortality decreased to about 6 35% in spite of the fact that opponents of my doctrine were always on duty there: the six years at the Rochus Hospital where the mortality was less than 1%, the experience of Dr. Bednar, the Chief of the Foundling nursery in Vienna, who saw the sepsis of the blood in the newborn become less common as a result of the chlorine washings, the four years at the Pest Obstetrical Clinic, the lying-in hospitals at Kiel and at Copenhagen And if I still cannot say after twelve years that, as a result of my doctrine of the origin and prevention of this disease, puerperal fever has not disappeared from lying-in hospitals and from private practice except for the cases of auto-infection, then the reason does not lie in the fact that this is not possible through the observance of my doctrine, but because the Professors of Obstetrics, with one exception, are still teaching error in regard to the cause of childbed fever. They are therefore to blame because the erroneouslytaught students and midwives within and without the lying-in hospitals are still causing so many cases of infection. A reason lies also in the dishonesty of the authors who write against me, and who do not quote, as we do in this work, all that is written in our favor, and all that has been written against us, but who follow the laudable practice (p 407) of ignoring everything written in our favor, and quoting only what has been written against us, so that the reader, less familiar with the literature, is Here belongs also Dr Silberschmidt, who ransacked the entire literature on puerperal fever and has found nothing in favor of my doctrine, and yet we could gather for this work so much that is in our favor

As for the two opponents, Kiwisch and Seyfert, whom Silber-

schmidt quotes, we have occasion in another place in this work to refute their doubts, and we only wish to remark that Silberschmidt has put his essay together not as a thinking investigator, but like a writing-machine, for as a thinking investigator, he would not have written on page 6, line 10, the following "But in spite of all this, it is very probable that puerperal fever did not occur so frequently at that time and even in the Middle Ages, as in later and most recent times, for which the erection of obstetrical hospitals bears no small blame"

Had Dr Silberschmidt written this as a thinking investigator, then he would not have referred, on p 118 on Kiwisch's authority, to puerperal epidemics which spread over whole country-sides Finally Dr Silberschmidt proclaims as the gratifying result

of the efforts of so many centuries of the pathology of puerperal fever Scanzoni's hyperinosis of puerperae, the pyemia of puerperae and the blood dissolution of puerperae The reader will recall that, in the course of our critique of Scanzoni, we have shown statistically that the inflammations of the puerperium which Scanzoni does consider as puerperal fever, are just as definitely puerperal fever as are hyperinosis, pyemia and blooddissolution, because the inflammations during the puerperium (p 408) which Scanzoni does not consider puerperal fever, are caused by the absorption of a decomposed matter, even as are hyperinosis, pyemia and blood-dissolution. Scanzoni divides the inflammations which are not puerperal fever into numerous forms and he asserts that he has observed a single form, ie endometritis, in hundreds of cases. If therefore hundreds of cases of puerperal fever do not fit into the Scanzonian pathology of puer-peral fever, then the reader has a concept of the completeness of Scanzoni's pathology of puerperal fever To make the nonsense complete, Scanzoni in his Textbook of Obstetrics, 1st Ed, V III, p. 470, and 2d Ed, V II, p 1014 discusses the symptomatology of the local affections of puerperal fever, the complications, the influence of the different blood anomalies upon local processes, the prognosis and the therapy of puerperal fever, so the reader will seek instruction regarding these subjects where he speaks of things which are not puerperal fever, namely in regard to the inflammations in the puerperium.

The Medical Faculty at Wurzburg has made itself ridiculous by awarding a prize to the work of Dr. Silberschmidt, which proclaims as the *non plus ultra* of the pathology of puerperal fever the Scanzonian pathology, from which the preponderantly greater number of cases of puerperal fever are excluded, and which opposes in a hostile manner the real keystone of all research into the pathology of puerperal fever, i.e my pathology of puerperal fever

It should be still fresh in your memory, Herr Hofrath, that in the critical examination of the tables, by means of which I have shown that in the Vienna Lying-in Hospital not a single puerpera died of a mental disturbance, I have come at the same time to the knowledge of the sad facts that, exclusive of transfers and of infants, (p 409) and because of easier calculation, too large a number of auto-infections was assumed. Still 6240 puerperae during 26 years in both divisions of the Vienna Lying-in Hospital died of infection from without, or in other words these 6240 puerperae died of puerperal fever, which could have been prevented And I am convinced, that if all those saved during the 26 years by all obstetrical aids could be expressed by a number, this number in comparison with the number 6240 would be a very moderate one You surely know, Herr Hofrath, that I propose to praise myself, since my opponents do not do so, in my self-praise I go so far as to assert that, with the exception of Jenner's cowpox-inoculation, in the entire field of medicine there is nothing capable of saving so many lives by the prevention of a disease as my doctrine on the prevention of childbed fever. long period from 1847 to 1860 was not sufficient to bring you to the recognition and acknowledgement of this eternal truth, You, Herr Hofrath, You, who are considered the foremost accoucheur of Germany (whether rightly or not, I will not discuss)

Then a corporation in which you, Herr Hofrath, certainly exerted a deciding influence, towards the end of 1859 awarded a prize to an essay which in a rather stupid fashion has battled against the eternal truth discovered by me

And perhaps to the advantage of injured humanity, I shall hold a mirror up to you, Herr Hofrath, and perhaps you will

take fright at yourself, when you see yourself in your true form and reform yourself.

(p. 410) Joseph Steiner, a candidate in Surgery and my pupil in the theoretical exercises in Obstetrics, wrote me from Pest, the following letter of March 30, 1858.

"Honorable Professor!

"Imbued with the truth of your lectures on puerperal fever, which I had the good fortune to attend during the course of the winter semester, I feel it necessary to present here conjectures as to how far it is possible that in the Gratz Lying-in Hospital all sorts of infections can occur

"When I attended surgery the first year in Gratz, there was a restaurant in the General Hospital which provided the food for the patients, and was also the rendezvous for all the students; later on the kitchen was given over to the Sisters of Charity and the restaurant was closed. For that reason, the students were compelled to use the dissecting-room as their meeting place, a place where colleagues assembled and where everyone killed time until the hour for the different lectures In the afternoon the first-year students, for whom dissection was obligatory, had to do their dissections, the candidates were therefore industrious habitues of the dissecting room and did not fail to instruct the beginners in all branches of anatomy, until they were called away, some to prepare for the "rigorosum," others to continue their observation in the lying-in hospital. As for the latter, they were always the most diligent attendants in the dissecting-room, since the lying-in hospital was separated from the General Hospital only by a street, the observers were therefore not to be blamed, if instead of remaining 24 hours on end (p 411) in the lying-in hospital, they sought diversion in the dissecting room, or (which is often the case) a poor candidate was on as an observer, when he might not remain away from the lying-in hospital for any long period, so he came to the dissecting-room to raise the money for a night lunch, etc, then left to continue his ob-Still he must have earned the money he received, and indeed by helping anyone of the students get his preparation ready My brother, who at that time was studying practical Obstetrics, frequently came to me in the dissecting room in order to study anatomy with me on the cadaver, or he helped me with the preparation which I had to present at a designated hour, and then left to continue his observation. I recall having gone once with him into the lying-in hospital, he laid aside his hat and cane, and examined a parturient I asked him why he first smeared his hand with grease? He answered—in order to lubricate his hand. I am convinced that had I seen him wash his hands in some liquid (which should have been none other than chloride of lime solution), I would have been just as curious to know what the liquid was. Since I did not notice, no further questions from me were needed. It must have been carelessness on my brother's part, the result of a complete ignorance of the origin of puerperal fever, which might be attributed to all "rigorosants" at Gratz, and might be searched for in further causes. Consequently such a rigorosant, or better, such a constant visitor to the dissectingroom is a source of great danger to the puerperae, because they bring about the same communication between the lying-in hospital and the dissecting-room, yes, I might say, between the latter and (p 412) the internal genitals of the puerperae, as there is between two rooms only with a common door. Actually the puerperae would not be exposed to such a danger in the dissecting-room, as in the lying-in hospital itself, for the examiner would certainly be afraid to examine a parturient with a hand which he had previously used to disentangle wet and bloody muscle-layers, but would clean it first. But since the puerperae must unfortunately be in the lying-in hospital and not in the dissecting-room, such a rigorosant must leave the dissectingroom in order to continue his observation So he dries his hand in the air, sometimes by sticking it in his pocket until he arrives in the lying-in hospital and then makes an examination with the same carelessness as did my brother For this reason, it is no mystery to me any more why at an investigation, the city physician of Gratz exclaimed. "The lying-in hospitals are true institutes for murder" Afterwards I asked the school-diener what this meant He answered as if it were one of the most trifling things in the world: "Ho! Ho! There lie a couple of puerperae on the bench in there, like lions" These are only surmises which I present here, but from them it follows that one is entirely correct in saying that puerperal fever is due to an absorption

"And now permit me, Honorable Professor, to request that I may be pardoned for being so free in burdening you with my letter, but the truth of your lectures arouses these thoughts in me and I cannot refrain, most worthy Professor, from acquainting you with them.

"Respectfully I remain always your grateful pupil."
You see, Herr Hofrath, that theoretic lectures over a period of some weeks on the origin and prevention (p 413) of childbed fever were sufficient to enlighten this candidate in surgery to the extent that he could make an entirely correct application of what he learned, and for you Herr Hofrath, who consider yourself as the foremost accoucheur in Germany, nearly 13 years have not been sufficient to free yourself from indoctrinated errors.

Surely the important difference, Herr Hofrath, between you and this candidate in surgery is not to be overlooked, for he comes to school with the consciousness that he knows nothing of the etiology and prophylaxis of childbed fever, while you, Herr Hofrath, are naturally deficient in this consciousness, and for that reason are so hard to instruct

And if in my fancy I picture to myself what would happen if Fate had put this candidate in surgery in your place, Herr Hofrath, then I believe that the provinces of Germany would resound less with the groans of the puerperae dying from childbed fever, engendered by your students and midwives, which you sent out into practice from the Prague and Wurzburg institutes of obstetrical training as so many colossal ignoramuses in regard to the origin and prevention of puerperal fever writer, he would not have so credulously put down the nonsense handed over to him, which up to now has been called the etiology of puerperal fever He would therefore not have steeped physicians who sought instruction in puerperal fever in his writings, in your dangerous and erroneous ideas to the ruination of those entrusted to their care As a writer he would have battled as obstinately on my side as you are doing against me As a member of the Medical Faculty at Wurzburg he would have prevented the prize-award to Dr Silberschmidt What crime you have committed as a practicing physician against humanity in that connection, Herr Hofrath, I cannot say, because it lies (p 414) quietly in the silence of the grave. The grieving humanitarian has recognized your life-saving activity as a clinician at Prague in the hundreds of dead puerperae whose postmortems in the Prague Lying-in Hospital you have had occasion to attend

And the longer I consider your efficacy as a clinician at Wurzburg,* then the more probable it seems to me that your opposition arises not so much from ignorance of the origin and prevention of childbed fever, but rather from ill will, because, Herr Hofrath, out of the 1639 puerperae cared for during six years in the Wurzburg clinic you have lost only 20 from childbed fever, therefore, assuming the same basis for auto-infection as in the Vienna Lying-in Hospital, only four cases of infection from without occurred. This is a result which closely approaches my most successful efforts, for during six years in the obstetrical department of the St Rochus Hospital I lost eight out of 933 puerperae from childbed fever, and among these there was one case of infection from without.

At the Wurzburg clinic, Kiwisch lost in one year, which one he does not say, 27 out of 102 puerperae from puerperal fever, therefore the ratio between your mortality and Kiwisch's is as 20 to 432 deaths

As a clinician at Prague during 15 months which you report, you had 59 further cases of infection from without

Herr Hofrath, you must account to the world how it happened that for six years you had such a favorable state of health among the puerperae at the same institution in which Kiwisch had a greater mortality than there was in the First Obstetrical Clinic at Vienna Kiwish had a 26% mortality At the First Obstetrical Clinic it was never over 15%

(p 415) I have told the world that I have reduced the 15% mortality at the First Obstetrical Clinic to one percent by the

^{*}Beiträge zur Geburtskunde und Gynaecologie. Herausgegeben von Dr. T. W. von Scanzom Würzburg Vol 3, 1858

destruction of the implicated decomposed matter. What have you done, Herr Hofrath?

Have the 1639 puerperae cared for in six years at Wurzburg not had the composition of the blood peculiar to gravidae, which predisposes them to puerperal fever?

Did the favorable Genius epidemicus, which in the Prague Lying-in Hospital lasted only one month after the introduction of the chlorine-washings, prevail in Wurzburg for six years?

Was there no winter in Wurzburg for six years, which brought no cold, damp days?

Among the 1639 puerperae cared for at Wurzburg, was there no individuality, which predisposed to puerperal fever?

Among the 1639 patients were there no women, weak, badly nourished, exposed during pregnancy to privation and need, or living under the influence of depressing mental states?

In these six years were there no prolonged labors?

Were there only four individuals among the 1639 affected by passionate, exciting or depressing emotional states?

Were these 1639 women devoid of all sense of shame? Or were they not used as material for examination or observation? Do the Wurzburg men examine with greater delicacy of feeling? Have these puerperae committed no errors in diet? What have

Have these puerperae committed no errors in diet? What have you done, Herr Hofrath, that the puerperal miasma cannot exert its murderous energy in the Wurzburg Lying-in Hospital?

How has the Herr Hofrath rendered harmless the two etiologic factors in childbed fever discovered by him? Why has no puerpera died fortuitously? Why has no (p. 416) puerperae died without any demonstrable cause?

Or, in other words, was your etiology of childbed fever lacking in the Wurzburg Lying-in Hospital, which gave you the opportunity in the Prague Lying-in Hospital to attend hundreds of autopsies on dead puerperae?

Or is the Herr Hofrath a more successful observer of my doctrine in private and my adversary only in public, since the time when he would not deny such infections in single cases?

Since the Herr Hofrath probably has not allowed the use of the chlorine-washings, yet tell us, Herr Hofrath, under what disguise then have you smuggled my doctrine into the Wurzburg Lying-in Hospital, so that it has made your etiology harmless, which gave you the opportunity of attending hundreds of postmortems on dead puerperae in Prague?

Have you, Herr Hofrath, such an aversion to the truth, that you awarded a prize to Dr. Silberschmidt's work, although he suppressed the truth about your favorable results in Wurzburg, proving the truth of my doctrine and referred rather to your experiments at Prague, which should have demonstrated the falsity of my doctrine?

Or does the Herr Hofrath live in the conviction that you shine only when surrounded by darkness? And have you for this reason sent Dr. Silberschmidt's essay out into the world as a dark fog, which the illuminating rays of the sun do not penetrate? You build your greatness, Herr Hofrath, upon the stupefaction of those who seek instruction from you, and thus upon the bodies of those unfortunate parturients who will be ground down in death by those whom you have made stupid

Should even human justice remain inactive in the face of conduct fraught with such misfortune, (p. 417) Herr Hofrath, you will not escape God's justice

Another member of the Medical Faculty at Wurzburg is Henry Bamberger, Professor of the Medical Clinic there * The reader knows that we consider puerperal fever an absorption fever; first comes the absorption of a decomposed matter, secondly the disintegration of the blood and thirdly the exudations

Henry Bamberger believes that we have the following view of the origin of puerperal fever, first comes the endometritis, then the absorption of the products of the endometritis, thirdly the disintegration of the blood and then come new exudations, we have never conceived the origin of puerperal fever in this manner, and we subscribe to all the reasons which Bamberger presents against puerperal fever originating in that manner

We have certainly proved by statistics that Scanzoni is in error when he believes that there are inflammations during the puer-

^{*} Deutsche Klinik, 8-12, 1850

perium which are not puerperal fever, and that these inflammations become puerperal fever only when the absorbed products of the inflammations later bring about a disintegration of the blood.

We shall return again to Prague and to Joseph Hamernik* in particular, as a member of that commission which had given Scanzoni in 1849 the task of investigating this problematic disease, and one gathers how profoundly this commission carried out their investigation from the fact that in 1860 this commission had still not communicated to the world the solution of this mystery. This can only be due to the fact that the investigation is not yet completed

(p 418) Afterwards Hamernik laments that our knowledge of the etiology is so defective, and on page 247 he says as follows: "Should any sort of a factor be considered as a cause of an existent disease, then the following questions must be answered in the affirmative every time: Has this cause always the same result? Can the disease under consideration be produced experimentally every time in this manner? In those cases where the disease is not caused by this factor, can the actual cause of the abortive experiment be assigned?"

We shall now see whether our etiology of childbed fever will meet Hamernik's demands The first challenge is unfounded, the reader knows that we injected decomposed matter into rabbits and that some of them died of pyemia as a result of this, and some did not

Was the decomposed matter not the cause of the pyemia in the rabbits that died, because it did not cause pyemia in all of them?

The second demand we have fulfilled for we have produced puerperal fever in rabbits

The third demand we have not fulfilled, for we cannot give the reason why pyemia did not set in in some rabbits. Instead we have fulfilled one demand which Hamernik did not make, but which makes my etiology of childbed fever a beneficial,

^{*}Die Cholera epidemica, Prag, 1850

eternally true etiology, 1 e we have caused the disease to decrease by rendering harmless the cause accused by us. And although our etiology accomplished more than Hamernik demands of an etiology in order that it can be considered the true one, nevertheless he says on p. 265 the following: "The statement that childbed fever is engendered by the transfer of cadaveric particles to the puerperae (p. 419) in examining them is absolutely erroneous and arbitrary."

"For childbed-fever epidemics are much older in medical experience, than post-mortem examinations"

What crass ignorance speaks out in this affair. The history of childbed fever teaches that puerperal fever occurred in great numbers only since the second half of the seventeenth century.

On p. 268 he says. "The isolation of territories and of districts, the cordons, the Contumazanstalten and similar institutions are derived from periods in which the physicians were not so advanced as to distinguish at the time of a raging epidemic, the epidemic diseases from others occurring at the same time, they were of the opinion that at the time of an epidemic practically all diseases were the result of the epidemic. Yes, one can still doubt whether under the conditions at that time an epidemic ever occurred, as often as one was said to be present, even for the establishment of the fact of an actual epidemic such knowledge was not so long ago ordinarily impossible."

The present work is intended to show that no puerperal epidemic is present. If therefore the majority of physicians today still speak of an epidemic, it is thereby proven that the majority of physicians do not have the knowledge necessary to recognize the non-existence of a puerperal epidemic. What value therefore can the observations on a puerperal epidemic have, as Hamernik supposes, if these observations were not made at time more ancient than the autopsies?

"They were due from the remotest times to the terror of the mother, even at times and in countries where opening the cadaver has not even been thought of." It is truly pitiful that Hamernik, who reveals such great talent for the History of Medicine, (p 420) has not yet devoted his talent to this branch in particular.

For the present we insist that, at times and in lands where the etiology under accusation is not active, childbed fever with the exception of single cases did not occur.

"We shall only state that the fear of childbed fever was never so great as in England and Russia, which in itself points to great and murderous epidemics which so terrified the people and the physicians. In England and Russia however for long periods of time no autopsies where performed and in England especially no body of a puerpera was opened."

The reports of the English lying-in hospitals published by us have proven that it is an error if one believes that childbed fever flourished in England particularly. We have also given the explanation why the mortality in England was so low, and if in spite of the lesser mortality, the physicians in England were more fearful of childbed fever than physicians are elsewhere, then this only goes to prove that they are more conscientious

And that the population elsewhere are terrified by childbed fever, has been so touchingly pictured by Scanzoni particularly

in regard to Vienna

How childbed fever behaves in Russia, I do not know, and Hamernik would therefore render me a great service if he would give the sources from which he has gathered his knowledge of the frequency of childbed fever in Russia

That he is very exactly informed about puerperal fever in England especially, is shown by the remark that in England no

puerperal cadaver is autopsied

(p 421) "Moreover circumstances prove that the puerperae are not examined as a rule after delivery" Infection takes place even during pregnancy and occurs most frequently during labor

"That puerperae who were neither examined during pregnancy nor before or after delivery (as happens with most street-births),

fall ill from puerperal fever just as do the others"

We have shown that the patients who were not examined, including the street-births, the premature births and all who are gravely ill, are protected against puerperal fever by the very fact that they are not examined

"That puerperal fever appears in epidemics (the sporadically

rare illnesses cannot be discussed here), i e are observed at certain periods, while in Vienna and Prague autopsies are done daily "But the students visit the lying-in hospital only at a certain time and are not present at autopsies daily

"That puerperal fever occurs at certain times in the country and in other cities where autopsies are not done, is more than sufficient; that puerperal fever epidemics are in no way traceable to the transfer of cadaveric particles (Semmelweis, Skoda)."

Puerperal fever does indeed occur in the country and in cities where no autopsies are done, but sick people are found everywhere, whose diseases engender decomposed matter and there are medical personnel of both sexes, who practice obstetrics and treat such diseases, and because of their ignorance cause infection

(p. 422) Joseph Hamernik was a member of the commission of which Scanzoni speaks as follows: "In this connection it would be desirable if the members of this commission would be freely elected from among an honorable Medical Faculty at Prague, so that the results of their investigations could be considered as the expression of a learned body of selected trustworthy men, and in authenticity and convincing virtue must prevail over the medical and non-medical public." I most solemnly protest.

Before we pass over to Bernard Seyfert, we shall say something about Baron Gustav Liebig, because we need his authority against Seyfert.

Liebig says in the eighteenth of his Chemical Letters on p. 312 the following "It is a fact that bodies in anatomical theatres frequently pass over into a state of decomposition, which communicates itself to the blood in living bodies. The slightest wound from knives which have been used in autopsies, very often produces a condition dangerous to life (cases in which persons fall victims to this fearful poison are not rare, as even recently Dr. Kolletschka and Dr. Bender of Frankfort-on-the-Main.)

The fact observed by Magendie, that blood, brain substance, bile, purulent discharges, etc in process of decomposition laid upon fresh wounds causes vomiting, languor and after a longer or shorter period of time, death, has not yet been contradicted "

In the third supplement to this paragraph, after giving a short abstract from Skoda's lecture at the Imperial Academy in Vienna, on p. 714 he says as follows. "From this lecture, it follows incidentally how scanty was the recognition which this great and practically important discovery received outside of the Academy. Certainly more causes of childbed fever will yet be made known, (p 423) but that the cause discovered by Dr. Semmelweis with all the ingenuity of an unprejudiced investigator is one of them, no impartial man can well doubt." The only cause of childbed fever is a decomposed matter, the sources of the decomposed matter are three, one of which is the cadaver.

Afterwards Liebig omitted these remarks in my favor from the 2d Edition of his Chemical Letters, and I made bold to question him in a letter and at the same time took occasion, although not without fear of receiving an answer full of amazement at the naivete of my question, to learn his opinion of the disinfective power of chloride of lime After that he obliged me with the following answer.

"Munich, March 21, 1859.

"Honorable Sir!

"I have the honor to answer to your inquiry, that the omission of your observation on childbed fever from the new edition of my Chemical Letters was not for the reason that I do not appreciate the importance of your experience as much as formerly, but because it is now so well-known and well disseminated, that its retention appears useless, it has no actual connection with the subject-matter. The same thing has happened with other additions

"Chloride of lime undoubtedly possesses a disinfective property.

Most respectfully,

Yours devotedly,

Gustav Liebig"

Bernard Seyfert has added complemental annotations to the remarks of Scanzoni previously criticized

The reader will recall that Scanzoni had the intention of performing animal experiments while a puerperal epidemic was raging in the Lying-in Hospital, the reader will recall that we

expressed the opinion that animal (p 424) experiments during an epidemic would be of no value because the obstinate epidemicists would say that the injections did not kill the animals and the puerperae, but the epidemic influences did

Seyfert has done just the opposite He says: "In October 1849, not one of the 186 women delivered became ill and died, to us this appears to be the most favorable time to determine the

value of the chlorine-washings"

Seyfert, by this statement, has exhibited either such unexceptionable evidence of mental poverty or such a remarkable proof of his own ill-will, that we would be completely justified in passing him over in silence. But Seyfert is now the Professor of Obstetrics in the clinic for physicians at Prague, it gives me cold chills to recall the enormous number of cases of puerperal fever observed in this clinic of Scanzoni's, Seyfert is the man to make these very observations

In view of such a frightful possibility, we shall be guilty of no dereliction of duty, and we feel the obligation which we may incur in case we do not strive to fulfill the task which fate has given us

Against Seyfert's ill-will, we cannot struggle, we can only endeavor to instruct him

Seyfert communicates the report of 15 months in which there took place 3056 births and 105 deaths and then asks whether these 105 deaths lie outside the scope of the cadaveric infection. If this be so, then we must indeed discover another power for these 105 cases.

The reader knows that for all cases of puerperal fever the cause has been found; i.e. the cause for all cases of puerperal fever is a decomposed matter. This decomposed matter, on an off-hand assumption, (p 425) is formed once in a hundred cases, accordingly out of the 3056 women cared for, 30 died because a decomposed matter developed in them But 75 women died because the decomposed matter was introduced into them from without, and one of the three sources, from which is derived the decomposed matter, which introduced into the patients from without causes puerperal fever, is indeed the cadaver.

The reader sees that there died 75 women who could have

been saved, and in truth this number was certainly exceeded, since Seyfert suppressed the number of transfers during these 15 months and the number of children infected

In view of these facts, Seyfert says: "We have too much understanding and heart to reject a subject of such great importance so obstinately, a subject we know is considered of great importance in Vienna, and for this reason, if proved true, we shall be called to account."

Seyfert says that in February, 1849 an important puerperal epidemic occurred in Prague while the state of health among the puerperae in the lying-in hospital during this month was a favorable one. The fact that the mortality among the puerperae in Prague was great in February, I will accept as true, but I cannot accept what Seyfert calls an epidemic.

The women delivered in the Prague Lying-in Hospital during February for the most part went from the city into the lying-in hospital immediately before labor, so why then did they remain healthy, if they were exposed to the epidemic influences of the city before their admission? But if in the month of February only such (p. 426) patients were delivered, who were admitted as gravidae in January, then their better state of health is again incomprehensible, because the Prague Lying-in Hospital and the City of Prague must indeed be subject to the same epidemic influences.

Again the explanation lies in the fact that more were infected in February in the city than in the lying-in hospital, and why not? Did not the physicians and midwives who practice obstetrics in Prague, attend the same school, where Scanzoni and Seyfert went? And if Scanzoni and Seyfert, who were such excellent students that they became Professors of Obstetrics in this school, have not learned how puerperal fever originates and how it may be prevented, how can one assume such knowledge among practicing physicians or indeed among midwives?

Seyfert says that he has no conception of the way and manner in which puerperal fever is inoculated through cadaveric poison (decomposed matter), because first, a wounded place is necessary, but this does not exist in the vagina (the absorbing surface

under normal circumstances is the internal surface of the uterus), and secondly, the material to be transmitted is necessary. But Seyfert considers it to be an exaggeration to assume that the decomposed matter is not wholly removed by washing with water and soap.

This assertion indicates a great talent for observation. In addition, Seyfert denies any disinfecting property in chloride of lime. It seems more than ridiculous to me to appeal to Liebig's authority against Seyfert in relation to the disinfectant properties of chloride of lime. I did not discover the disinfectant property of chloride of lime, I have only made use of it, and believe that if it had done nothing else than what it accomplished in the First Lying-in Clinic in Vienna, then its disinfectant property would be adequately proven.

(p. 427) Third, this implanted matter must bring about a local inflammation, and go on from there into the lymph vessels and cause venous pyemia. We have never seen at autopsy such a process in the vicinity of those parts of the genital organs, which were within reach of the finger before labor. (We have already and too frequently told how puerperal fever originates, for any

necessity of saying it over again)

Finally, says Seyfert, if this were so, pyemia must indeed occur much more frequently in the women's division than in the lying-in hospital, for in the women's division lesions occur in the vagina and the cervix more frequently, but no single case was known to him where pyemia was caused in this manner in the women's division

As for pyemia in the women's division, I have had no experience on that point. I have, as I have already related once, never been an attending gynecologist. I made my gynecologic studies in the dead-house, for six years I have even directed a gynecological division, however at a time when I certainly knew how to prevent infection. But I am convinced that the internal surface of the uterus, and the uterus during pregnancy, during labor or during the lying-in period is far more suitable for absorption than in a non-puerperal state, that infection therefore occurs more easily in the lying-in hospital than in a gynecological department. If

Seyfert says he has never observed an infection in the gynecological department, then it only goes to prove that he is a poor observer, he says the same of the lying-in hospital also, but we have certainly demonstrated to him 75 cases of infection from without inside of 15 months

Because a blind man does not see colors, the non-existence of color is not thereby proven

(p 428) When I was a student of practical obstetrics at the First Clinic in Vienna, Chiari was Assistant, in his lectures on puerperal fever, he said that the epidemic influence was many times so virulent that even individuals not in the puerperal state were attacked by puerperal fever. As proof he cited a case, which was admitted into the obstetrical clinic suffering from fibrous uterine polyps and died before the operation, the autopsy showed the pathologic-anatomic findings of puerperal fever. After the success of the chlorine-washings showed how puerperal fever originated Chiari again called my attention to this case with the remark that now he knew that this individual as well as the puerperae was infected by a decomposed matter.

And how deplorable also is the condition of the patients cared for in the gynecological department, as proved by the reports on the results of the department, and taking the case of the uterine polyps only, how often such patients die of pyemia before operation, how often such patients die of pyemia after the excision. I have directed a gynecological department for six years, I take all cases reporting with uterine polyps during the five years since I have been Professor, I have frequently had opportunity to operate on uterine polyps in private practice, I have removed this specified number of polyps by excision. Not only have I not a single case of death to deplore, I have not even seen a single significant case of illness after excision, although there were polyps with pedicles a hand's-breadth in length. These favorable results I ascribe only to the fact that I operate with clean hands

According as we thus instruct Seyfert, and according as this work must effectually prove to him, that my views on the origin and prevention of childbed fever (p 429) have been proven by test, so we hope that Seyfert will have so much understanding and

heart as not to reject obstinately a subject of such great importance, because he must assuredly be accountable for the devastation which thereby occurred among the puerperae entrusted to his care

De mortuis nihil, nisi bene,* can apply only to the moral qualities of the deceased

The scientific activity of the dead may as well be subjected to the criticism of the succeeding generation as to that of their contemporaries It would be a sorry thing for truth, if the errors of one who taught error, would be stamped as fact on the death of such a person

With these premises, we shall take up the critique of Kiwisch. Kiwisch v. Rotterau† discusses Skoda's paper at the Academy of Sciences in Vienna on my views on the origin and prevention of childbed fever, and announces that he does not agree with Skoda's manner of viewing things which speaks of a new discovery, the assertion that puerperal fever is caused by infection with decomposed animal matter and especially also cadaveric poison, is one made many years ago, proposed from many quarters and actively defended, and this view would have prevailed if it were possible for the physicians concerned in the matter to furnish convincing proof. For Dr Semmelweis however there remains only the problem of supplying for the Vienna Lying-in Hospital the proof that the cause of the violence of the disease is above all due to the transmission of deleterious animal matter. (p 430) That he endeavors to do this with such great perseverance, and as it seems, with so much success, cannot be denied as a great service by anyone

It is indeed correct that English physicians have made the observation before me, that decomposed animal matter is capable of causing puerperal fever. But in how limited a fashion the English physicians admitted this and what an essential difference there is between the views of the English physicians and of

^{*}Nothing but good of the dead

[†] Zeitschrift der k k. Gesellschaft der Aerzte zu Wien. Year 6, v. 1, p 300

myself on the origin of puerperal fever, we have thoroughly discussed from p 181 to p 199

But that Kiwisch does not recognize this truth even in the limited fashion of the English physicians, he has shown most convincingly

Kiwisch in his review for the "Canstattischen Jahresberichte" for the years 1842–1845 inclusive, reports these same observations of the English physicians which have been communicated to us by Arneth. The review of 1842 Kiwisch closes without any remarks Had Kiwisch been aware what blessed truth was contained in these experiences, would he not have given expression to unrestrained joy, that it was finally possible to free the parturient sex from its greatest scourge?

Kiwisch closed the review for 1843 with the following remarks. "According to the reviewer's opinion, the statements of the author certainly still require more precise demonstration and extensive corrections"

The review of 1844 is closed by Kiwisch with the following remarks: "The reviewer does not allow himself any remarks upon this communication of Elkington, because he does not know how far it is completely reliable"

In the review of 1846, he makes the following remarks. "(Ref.) At any rate it must be extraordinary that such observations, which are so frequently reported by English physicians, (p 431) are proportionately very seldom made on the continent and by experienced physicians not at all Thus the reviewer must state, that although he has devoted much attention to this investigation for several years, it was never possible for him with the ample opportunities offered to gather experience which would have been So frequently after only half way decisive for these assertions doing autopsies on women dead of septic puerperal fever, he had to attend parturients and puerperae without any special precaution, nevertheless he could not perceive in any case that this was in any way prejudicial to the puerperae He could never discover the origin of puerperal fever through infection from a gangrenous erysipelas, and in the lying-in hospital in which he served, he never observed an illness of a non-puerpera which one could

accept with any degree of plausibility as coming from puerperal fever

The future may perhaps offer a more exact interpretation of these devious experiences and opinions "

The following anecdote may give the explanations of these devious experiences and opinions

Once an Englishman, a Frenchman and a German wished to

form a conception of a lion

What did the Englishman do? He made a journey to Africa and there learned what a lion looks like The French man went to the Zoo in order to see what a lion looked like, what did the German do? He locked himself in his study, sat at his desk and in his imagination built up his idea of a lion A chimera obscures the outlook to such an extent that the truth cannot be seen The highest mortality at the First Obstetrical Clinic at Vienna in one year was 15% Kiwisch gives me a great deal of credit for having reduced this mortality due to infection; in Wurzburg he had a mortality (p 432) of 26% and nevertheless says that he went to deliveries from doing autopsies on women dead from septic puerperal fever, without having observed any harm to a single case. There was no lack of harm, as the 26% mortality proves, but the ability to recognize harm was lacking And that Kiwisch had no presentiment of the salutary truth which lay in the observations of the English physicians, and published by him in the "Constattischen Jahresberichten" for 1842-5 inclusive, appears indubitable from the circumstance that in the 1854 edition of his "Clinical Lectures" sent through the press unchanged by Scanzoni, he explains the fact that puerperal fever remains limited to the practice of a single physician or midwife, by saying these are the busiest physicians or midwives, as if it were possible to care for so many puerperae at one time in private practice and that even several deaths could only be cases of auto-infection. a physician or a midwife for example lost only 4 puerperae in a short time from childbed-fever, would it be possible for either of them to treat 400 puerpera in private practice in this time.

In the same essay in which he gives me a great deal of credit for having decreased the mortality at the First Obstetrical Clinic

through the prevention of infection, he says that he does not notice whether his students come out of the nearby dead-house or not. If Kiwisch had not said that he took no notice of this, we should know it nevertheless, because a 26% mortality could only occur in such a lying-in hospital where no notice is taken, whether those who examine the patients come out of the dead-house or not

How completely Kiwisch passed by the observations of the English physicians, is shown by the fact that, in his "Clinical Lectures" published in 1854, childbed fever is defined (p. 433) as a disease of miasmatic origin; and that he was not clearly informed on his own doctrine is shown by the fact that he forgot to explain how the development of the miasma may be prevented, or if already presented, be destroyed Kiwisch was not aware that a miasmatic disease is preventable

To refute what Kiwisch has said in favor of the earlier accepted etiology and to the discredit of my etiology, would be superfluous, because we could only repeat what we have already said, and whoever reads this work attentively will realize the truth. There are only two points which we throw light upon once again, because Dr Silberschmidt refers to them Dr Silberschmidt says "Neither can, as Kiwisch observes, the epidemics disseminated over whole countries be explained by the introduction of cadaveric poison. The author himself has observed many cases of puerperal fever in the country and in the city, where the labors were normal and there never was such a factor as this present."

Kiwisch was in Vienna twice solely for the purpose of discussing this matter with me and yet he always speaks of the cadaver only there are scattered over whole country-sides sick people, whose disease engenders a decomposed matter and over whole country-sides there are scattered physicians and midwives, who treat such patients and also gravidae, parturients and puerperae, and these physicians and midwives did not learn in school how puerperal fever originates and how it can be prevented, and for this reason puerperal fever is spread over large areas of the country

Dr Silberschmidt refers to the statement of Kiwisch, who says: "That he took no notice whether students came from the nearby dead-house or not, (p 434) yet the state of health among the

puerperae during the last two and one-half years was very satisfactory, while on the other hand towards the end of the year 1846, when no clinical visit was made during his absence and no autopsies were done by the Assistant in attendance, puerperal fever broke out in the most frightful manner and in spite of all precautionary measures ceased completely only when the warm season of the year was well advanced and while the clinical examinations were still carried out by him in the usual manner

I have shown that in Vienna puerperal fever in the great majority of cases originates from the introduction of a decomposed matter from without. Since the laws of nature are the same all over the world, then puerperal fever will certainly break out in the same manner in Wurzburg as in Vienna. That it did not actually arise from an unpreventable atmospheric causes was proven by Scanzoni, because he lost only 20 out of 1639 patients from puerperal fever over a period of six years. Scanzoni's mortality therefore, as we have already shown, has a ratio to that of Kiwisch of 20 to 432 deaths.

Finally we permit ourselves the following further reflections on Dr Silberschmidt's opposition to our doctrine on the origin of childbed fever. In order to prove the incorrectness of my views, he refers to the futility of the chlorine-washings as observed by Scanzoni in Prague over a period of five and one half months

Dr Silberschmidt ignores Scanzoni's six-year success in Wurzburg, probably not as a result of the chlorine-washings, but at any rate with the help of my doctrine, observed under what form I do not know

(p 435) The credit which might be due Scanzoni he ignores, but the error which Scanzoni committed, he rescues from oblivion, is it not an error if Scanzoni, in order to determine whether puerperal fever is engendered through atmospheric influences or through the absorption of a decomposed matter, ascertains by experiments with chlorine-washings that the puerperae die fortuitously and without any demonstrable cause?

Dr Silberschmidt refers to some adverse experiments which Kiwisch performed at the Wurzburg clinic, although Kiwisch's observations are controverted by Scanzoni's six-year success

Although Dr Silberschmidt passes over Scanzoni's meritorious

service in silence and instead recalls his error to the memory of the world, yet this essay was awarded a prize by an organization of which Scanzoni is a member The explanation of this phenomenon is very easy.

Silberschmidt must certainly show that my views on the origin

of puerperal fever are erroneous.

For if my views on the origin of puerperal fever are true, then the Scanzonian pathology of childbed fever is a colossal folly, as we proved in the proper place

But this pathology must be offered to the world as the flower of the efforts of the century, and whatever stands in the way of this scheme will find no quarter, not even the truth. That such an opposition can come only from an unscrupulous dishonesty, will be evident to the unprejudiced reader. O merciful God, when will puerperal fever cease to spread over whole country-sides, if the medical personnel of the country are made stupid by such an unscrupulous and dishonest opposition?

(p. 436) The medical faculty at Wurzburg can thank Scanzoni

that he has lead it out upon treacherous ground.

Dr Hermann Lebert, Professor at Breslau.

We would not quote Lebert, because he is too insignificant an adversary to make it worth while to consider him, but Lebert is proof for the fact that Kiwisch had no right to assert that in 1842 he already knew that puerperal fever was engendered as I first taught in 1847, because his pupil Lebert does not yet know in 1859 the cause of puerperal fever. Lebert still defines puerperal fever in 1859 as follows. "Puerperal fever is a febrile disease peculiar to puerperae, and of miasmatic origin, which finally brings on a blood-disease, which according to its various characteristics evokes local (mostly inflammatory) manifestations, to which however belong the common characteristic that at the beginning of the disease they localize by preference in the reproductive organs, and rarely at the same time, mostly not till later, appears in those structures of the remainder of the body, which are organically united with or are an anatomic analogue of the part of the uterus, with which they are in closest contact" And of what Kiwisch already knew in 1842 of my teaching, Lebert expresses himself as follows "Whether direct inoculation by cadaveric poison from a cadaver dead of the same disease can occur, as Semmelweis has elevated formally to a system, is doubtful, at any rate, this also would be only one of the many possible means of transmission" If Lebert is not adequately familiar with this matter, then it would be better to be silent than to presume an opinion, or if Lebert knows that the mortality of the First Clinic, which rose to 518 deaths in a year, was reduced to 45 deaths in 1848 through prevention of direct inoculation, and yet considers it doubtful whether puerperal fever is engendered by direct inoculation, (p 437) then he has not given any brilliant evidence of his sagacity.

Lebert acknowledges himself as a pupil of Kiwisch by the following declaration. "After the example of Kiwisch, to whom we owe by far the most abundant, best and fundamental work on this subject, we shall first describe puerperal fever, which might be better designated as puerperal intoxication, and then examine its most important localizations one after another

"Herewith we shall frequently rely upon the discussion of this subject which took place some years ago (1858) before the Paris Academy of Medicine, but in general we shall remark, that this same discussion has brought to light little that is new, that the now over twelve-year-old description by Kiwisch in his Clinical Lectures still stands far above anything included in the final report of this discussion by Guerard, and that we completely miss in that discussion a really new viewpoint as well as new observations, chemical experiments and research in experimental pathology We add that the expression on the constitutional disease on the part of the Academy after all only established the fact long accepted by the better pathologists, and that the proposal to close all the larger lying-in hospitals manifestly seems to be one of those rash and inconsiderate inspirations of the moment, which strongly recalls the banal adage, "to pour the baby out with the bath-water" In a word, once again it was a piece of beautiful improvisation, but scarcely a source of real instruction"

I hope that my students, if they write on puerperal fever, will

give another definition of this disease, than that Lebert gives; I hope that even Kiwisch's essay on this disease will no longer (p 438) be considered by far the most abundant, the best and the fundamental work as it is to be expected that he will agree with Lebert's critique of the discussion of this disease in the Academy of Medicine at Paris.

In the general assembly of the Imperial and Royal Society of Physicians on May 15, 1850,* I gave a report on my theory of the origin of puerperal fever, on which a discussion arose, which was continued in the general assembly on June 18 and July 15, 1850 Dr. Zipfl participated in this discussion as an opponent of my views

Dr Zipfl was an Assistant in 1842 and 1843 in the clinic for midwives, at which time I was an aspirant for the Assistancy at the clinic for physicians, while making my gynecological studies in the morning on female cadavers in the dead-house, at the same time I saw Dr Zipfl do autopsies very frequently on the puerperae who died at the midwives' clinic

Later when I encountered Dr Zipfl at a time when the success of the chlorine-washings had already become known, he congratulated me and assured me that even he had a confused notion of the matter, that he had not clearly grasped the facts, that the data in the midwives' clinic were not so convincing as in the clinic for physicians. Had he been Assistant in the clinic for physicians, where the facts were so apparent, he would certainly have expressed this same conviction

Encouraged by such a statement, I permitted myself the remark that I was convinced that the autopsies which I saw him do were the reason why, during his Assistancy, the mortality in the midwives' clinic (p 439) was the greatest ever known (see Table No I, p 3) At the same time I appealed to his love for the truth with the request that I be permitted to use this datum along with his name, which Dr Zipfl freely granted with the remark that it was no disgrace to be a devotee of pathologic anatomy

^{*}Zeitschrift der k k Gesellschaft der Aerzte in Wien Year 6, v 2, year 7, v 1

I was not a little surprised when Dr Zipfl, after I had availed myself of his permission in my discussion, set himself up as an opponent and was amazed that I had linked his name with such a great mortality

And to prove that the autopsies done by him were not the cause of the puerperal fever observed in the midwives' clinic, Dr Zipfl had collected all the autopsies protocolled under his name in 1842, of which there were 41 and compared these autopsies with the labor-records and thus he found that a great number of the fatal cases did not deliver on the days when he did the autopsies, and that of those parturients who delivered a short time after the autopsies recorded, just a very few became ill, while those parturients who delivered the longest time after the recorded autopsies (24–36 hours) died in the greatest numbers

I have seen Dr Zipfl do autopsies so frequently that I am convinced that of the 202 puerpera who died in the midwives' clinic in 1842, only a few were not autopsied. If only 41 autopsies were recorded, then the reason is that the greatest number of autopsies on puerperal cadavers were not recorded because of the similarity of the findings.

The puerperae who delivered on days when no autopsies were recorded, were infected from unrecorded autopsies, and if Dr Zipfl says that every single patient who delivered immediately after recorded autopsies, remained healthy, and those who delivered later, (p 440) became ill and died, then he says something which my doctrine establishes those who delivered immediately after a recorded autopsy, at the time of the examination following an autopsy were already in the stage of expulsion and could not be infected because of the inaccessibility of the absorptive internal surface of the uterus, while those who delivered later, were in the stage of dilatation at the time of the examination following the recorded autopsy, and were infected because of the accessibility of the absorptive internal surface of the uterus

Although Dr Zipfl assails the facts supporting my opinion, yet he claims priority for himself and for Fergusson, the same Dr. Zipfl who has done so many autopsies and did not disinfect himself and for that reason 366 puerperae died out of 5398 over

a period of two years, consequently almost every second day a puerpera was lost as a result of preventable infection from without, not counting the babies

What punishment would be severe enough for such a criminal? Yet I would ward off punishment for Dr Zipfl because I have proved that he was most deeply ignorant of the cause of puerperal fever at the time when almost every second day he lost a puerpera who could have been saved, in addition to the babies

Fergusson says that Gaspard and Cruvelhier have injected decomposed matter into the vascular system, and thereby these same inflammatory reactions were produced in animals as we find in puerperae Both experimenters have damaged mechanically the vascular system of the animal by the introduction of wood-splinters into the vascular system, and produced the same process Both these noxious influences, says Fergusson, we find in puerperae and for that reason childbed fever is engendered by them.

By separation of the placenta many vessels (p 441) are torn apart, during the healing of the wound, which the placental site represents, the wound secretion can assume an ichorous character and thereby cause puerperal fever—According to Fergusson, all cases of puerperal fever are cases of auto-infection, in my opinion puerperal fever in the overwhelming majority of cases is caused by infection from without—In 1846 at the clinic for physicians in Vienna 518 puerperae died, in 1848 45 died—Was the decomposed matter, which was introduced from without, destroyed in 1848? Or the decomposed matter which was formed at the placental site?

If therefore Dr. Zipfl considers Fergusson's and my doctrine identical, then he neither knows what Fergusson teaches, nor what I teach

Prof Hayne* expresses his astonishment that even a contest could arise over priority, because the manner of explanation now set out as new for the genesis of puerperal fever in man was

^{*}Handbuch uber die besondere Krankheitserkenntniss und Heilungslehre der sporadischen und seuchenartigen Krankheiten der nutzbaren Hausthiere von Anton Hayne Wien, 1844

already published by him in 1830 in his veterinary work on the

presence of a similar fever in cattle

Prof Hayne says as follows on p 618: "Since local affection everywhere occurs only as a result of mechanico-chemical and dynamically harmful influences, then this also should be the case in litter-fever. difficult and long-drawn-out, but especially rude, precipitate and unsuitable artificial aid of a very strenuous nature in progressing casts, the coincidental accidental or intentional injuries, the excessive accumulation of forage in the stomach and intestines, of urine in the bladder, the taking of irritating rotten food (p 442) or the use of heating, acrid, balsamic, violently irritating drugs sometimes working specifically upon the sexual-and urinary organs, but above all, the suppressed perspiration as a result of the chilling from raw, cold and damp weather, forage, environment, etc

Although any one of the above adverse influences is usually responsible for the origin of the disease, yet it can happen that no noxious element, to which the disease could definitely be ascribed, would be found For that reason even there may be justification for the assumption either of a miasma or a contagium, in which case the disease may occur epidemically, so much the more as the cast ensues commonly at the same time, the animals referred to are uniformly disposed and exposed to the same invasions However, it must nevertheless be observed, that such results which would speak for the infection, among the animals as well as is the case among the puerperae in the lying-in hospitals, probably does not therefore occur But everywhere parturition takes place exposed, even in the case of a contagium developing, by the customarily frequent examinations of the genital organs (which does not occur in animals), probably an infection may result from a sick patient to another completely healthy, but extremely sensitive and easily injured, uterus

On p 621 says Prof Hayne "That the foaling-, calving-, etc fever is similar to puerperal fever, it is almost unnecessary to recall, one has, however, as already has been mentioned, had no experience which would speak for a contagiosity, consequently

from the official veterinary view-point nothing is to be quoted but only to add, that in the place where the disease should appear to be epidemic, every sort of chilling and overfeeding must be avoided, a foresight, which is all the more unavoidable, (p 443) although sometimes even some miasmatic activity seems to be in the atmosphere, to get rid of which and to make it harmless lies mostly beyond human ability "

The reader will judge for himself, whether Prof Hayne had observed puerperal fever engendered already in 1830 in animals, as I taught in 1847 it was engendered in man

As a second adversary Dr Lumpe enters in

Dr Lumpe* says. "If one considers, how since the first appearance of puerperal fever epidemics the observers of all ages have racked their brains in order to find its cause and to prevent its occurrence, then the theory of Semmelweis appears to us just as does Columbus' egg I confess that in the beginning I myself was highly pleased when I heard of the fortunate results of the chlorine-washings and to me it is certain so was everybody who had the misfortune to see so many robust individuals in the bloom of youthful vigor fall victims so quickly to the devastating epidemics, like so many enervated, broken, pitiable wretches as I, during my two-year Assistancy at the First Obstetrical Clinic, observed such frightful variations in the cases of illness and death, many legitimate doubts must have been awakened in me about the popular manner of origin and prevention more keenly I examine these doubts, the more distinctly they stand before me as the logical contradiction, against which the pious longings of humanity cannot hold their own in the field of exact science."

I wholly agree with Dr Lumpe when he says that my theory appears to him to be the egg of Columbus I myself very often expressed my astonishment that the glaring contradiction between (p 444) the daily observations and my doctrine has urged on me the conviction that these things did not occur long before me

But if Lumpe says that the pious longings of humanity cannot

^{*}Zeitschrift der k k Gesellschaft der Aerzte Year 6, v 2, p 392

stand before the logic of exact science, then I am of a different

opinion

During the two-year service of Dr. Lumpe from September, 1840 to September, 1842, there occurred in the First Obstetrical Clinic 5653 deliveries, of which number the deliveries for December, 1841 are not included, because the report of this month is lost to me. Of these, there died 662 puerperae, therefore 606 puerperae as the result of preventable infection from without, or in other words, in these 23 months not including the transfers or the children infected from the mothers, almost one woman a day, who could have been saved, it is the desire of humanity that such a dreadful expenditure of human life should cease. With this essay we fulfill this desire of humanity, we have in this work built up a logical, exact science on the origin and prevention of puerperal fever. What Lumpe calls logic, and what Lumpe calls exact science, is a conglomerate of errors

Lumpe says he was greatly delighted when he heard of the fortunate results of the chlorine-washings, but he had some doubts and instead of freeing himself from these doubts by study, he considered them as true and the indubitable fact of the results as false, ascribing the results to accident. This is logic, this is the exact science according to Lumpe and to this logic, to this exact science the pious longings of humanity must yield and for all eternity at a single obstetrical teaching institution, almost one puerpera must fall a daily victim to this logic and to this exact science

(p 445) The monthly report of Dr Lumpe's period of service in 1841 and 1842 the reader will find on p. 106, Table No III, the report for 1840 follows here.

Month	Births	Deaths	Percent
Sept Oct	270	38	11 11
	215	63	29 30
ov	216	42	14 81
Dec	222	48	21 62

Dr Lumpe says "If the cadaveric poison is the cause of a disease, so must necessarily its effect (since logically no specific

disposition therefore can be assumed) stand in direct proportion to this cause, as the more frequently the cadaveric poison is carried over by the examining finger to the puerperae, the more frequent must be the cases of disease and deaths and vice versa."

I agree with Lumpe if he says that the more frequently the cadaveric poison is introduced, the more frequent must be the cases of disease and vice versa. But the assertion that there is no specific disposition towards the cadaveric poison is again an exact Lumpe-science. Daily experience teaches that pyemia does not always follow an injury at an autopsy, just as all rabbits, into which decomposed matter was injected, do not die from pyemia

Dr. Lumpe says: "We see now how the facts may be reconciled with the demands of inexorable logic." Lumpe says. "During my period of service, there was such a difference between the maximum and minimum of mortality, that one could think of nearly everything else but a common invariable cause"

The common cause of all puerperal fever which ever were and still will occur, is of course a decomposed animal-organic matter. But if Dr Lumpe asserts that the decomposed matter may be an invariable cause, i.e. that the workers in the lying-in hospital are always contaminated to the same degree with decomposed matter (p 446) and for that reason the mortality should undergo no variations, but always remain the same, then this is an assertion which bears all the characteristics of the Lumpe exact science.

That puerperal fever occurs only in proportion to the introduction of decomposed matter from without, we have adequately proven in detail by almost four proof-sheets in this work, ie from p 114 to p 213.

from p 114 to p 213.

Dr Lumpe says. "If with this we now compare the maximum of mortality during the use of the chlorine-washings—in March, 1849 there died 10 puerperae*—then, if Semmelwies' theory should be true, we can accept only those cases exceeding the

^{*} Dr Semmelweis explains that it was told to him at the time of this great mortality, that the washing with chloride was neglected Whether this is right, and, if so, to what extent, Dr Braun, in whose assistantship this month falls, must give a more accurate account I can only give hearsay evidence in this regard

maximum as infected, according to the rules of logic and according to logical conclusions we are forced to make the statement, that a poison which is so intensive that the least, scarcely demonstrable quantity may cause the death of the healthiest puerperae, may remain over a long period of time as mild as almond-juice, then again overrun the lying-in wards like a devastating pestilential stench. For from February, 1841 up to and including September, 1841, as you see through eight whole months, then from May up to and including July, 1842, the number of fatal cases remain always—and with the exception of two months—considerably under 20"

It is evidence of exact science, if Lumpe considers only the absolute mortality Kiwisch had 27 deaths, in the Vienna Lying-in Hospital there died 730 puerperae, therefore Dr. Lumpe does not doubt that Kiwisch had a more favorable state of health than the Vienna Lying-in Hospital

(p 447) This is absolutely false! Kiwisch cared for 102 puerperae, consequently he had 26% mortality, in the Vienna Lying-in Hospital in 1842 there were cared for 6024 puerperae, accordingly there died 12%, hence the mortality in the Vienna Lying-in Hospital with 730 deaths was about 14% more favorable than for Kiwisch with 27 deaths

In March, 1849, 406 puerperae were cared for, of whom 20, 1e 4.92%, died True exact science claims that I out of 100 puerperae died of puerperal fever, if therefore 20 died out of 406 puerperae from childbed fever then at least 17 puerperae died, who could have been saved When we place this demand of true science on the origin of childbed fever alongside the performance of Lumpe, then it is evident that only once, in May, 1841, less than one out of one hundred puerperae died, that in the other months several were infected to the same degree, that on the average nearly every day a puerpera died, who could have been saved The reader knows that at the First Obstetrical Clinic from time to time transfers in great numbers of sick puerperae were made

Inspection of the records of these transfers was refused, if I had been permitted to examine these records, than I probably

could answer to the inexorable logic and exact science of Lumpe, in the very months in which the cadaveric poison was as mild as almond-milk, so and so many hundred sick puerperae were transferred to the General Hospital That during Lumpe's service numerous transfers were made, is a fact, a mortality of almost one puerpera every day, who could have been saved, is so abominable that disciplinary measures should have been called for, only I do not know the months in which the transfers occurred, the records still exist, and the reader can (p 448) be convinced that the publication of the records should come eventually, if they speak against me, but if there appears no publication, then the reader can be certain that the records are in my favor.

Dr Lumpe says "We search for still further conclusions, which follow from the application of the suggested mode of explanation to the established, incontestable and—indeed I need not add—scrupulous honesty to the facts used for evidence"

Dr Lumpe now presents a table, from which it follows that the less frequent the opportunity of contaminating the hands, the greater the mortality, and the more frequent the opportunity of soiling the hands, the more the mortality was reduced, and says "We have therefore arrived at an absurdity in the demonstration"

The established, indisputable fact used with scrupulous honesty for evidence, which serves as a basis for this table, is the assumption that only during the obstetrical course with exercises on the cadaver have the students the opportunity to contaminate their hands, how wholly false is this assumption is well known to Lumpe himself, because he says in the same essay that the candidates came directly from the dead-house for the morning visit Lumpe's course consists of six weeks of theoretical lectures, during which the last three days are devoted to one-hour exercises on the cadaver

Lumpe says the greatest mortality was in October, 1840, (p 449) when 63 out of 215 puerperae died, and he had had no course with exercises on the cadaver during this month, but during the eight months within which less than 20 puerperae died, he

had had one to two exercises on the cadaver, even in May, 1842, he had had four courses and yet only ten women were lost, while during January, 1840, 64 puerperae died during one course.

If in October, 1842 Lumpe even had no course with exercises on the cadaver, then the students came after all from vacation with fresh zeal, attended the autopsies, went directly, as Lumpe himself says, out of the morgue from the autopsies for a visit to the lying-hospital, this kept up until the warm season of the year made their visits to the dead-house as well as to the lying-in hospital so unpleasant that their diligence relaxed and the greater mortality in the colder season of the year is only the result of the industry of the students at that time. The obstetrical courses with exercises on the cadaver in the warmer season of the year—at which time there is a simultaneous lesser mortality—were held after the afternoon visits and for this reason were less dangerous, because the students scatter after the completion of the day's work and visit the hospital no more that day

Lumpe says that the operative deliveries are particularly exposed to the greatest danger of infection, because of the frequent examinations which are made, and yet in eight months the number of fatal cases was much smaller than the number of operative deliveries. Naturally, because these eight months came in the warm season of the year when examinations were made with cleaner hands. Had Lumpe briefed the operative deliveries during the winter months, then it would have been shown that the mortality after operative deliveries would have been very great.

Dr Lumpe says "If the results of a poison do not demonstrate an established actuality of a contagiousness over a period of eight full months, then there exists no reasonable argument against the assumption that this can also be true of other years The chlorine-washings were practiced for 3 years"

We have shown that only in May, 1841, according to the lying-in hospital reports, the cadaveric poison did not make itself manifest, (p 450) but we consider it possible that probably in the very month of May, 1841, 60 to 80 very sick puerperae were transferred to the general hospital We live now in 1860, there-

fore it is no longer merely three but 13 years, and these accidental drops in mortality have repeated themselves in various places "With the theory of puerperal fever it goes as with all theories,"

"With the theory of puerperal fever it goes as with all theories," says Lumpe; "e g the physicist formerly explained the phenomena of light with the emanation theory, and now in the case of the vibration theory what assurance is there that this is the correct one?" Light does what it ought to do, untroubled by the explanations of the physicist, but puerperal fever is very dependent on the explanations of the physician

Dr Lumpe accounts for the origin of puerperal fever by epidemic influences and sends almost one puerpera daily to the morgue, I accounted for the origin of puerperal fever by the introduction of decomposed animal matter from without and in 1848 sent 45 puerperae to the dead-house, and I lament that, among these 45 women, there were at least ten who could have been saved, if I did not have to battle against unfavorable conditions

If I were concerned merely with just another explanation for an unalterable mortality, then I would know better how to spend my time than romping around with the errors and the malevolence of my adversaries

Dr Lumpe says: "Semmelweis believes he sees a convincing argument for his opinions in the circumstance, that in the First Clinic the mortality was strikingly greater than in the Second, although the conditions were the same. He obviously ignores a circumstance here that seems to me to be of the greatest importance. It is the following: since admissions were made into the First Clinic on four days a week, and what is more on two days in succession, in the Second on three days a week, then a complete airing of the lying-in ward is possible very seldom during the year in the First Clinic, while it is carried out regularly in the Second."

I have not mentioned this circumstance, because in relation to the mortality of the First Clinic it is entirely irrelevant, only such an exact science, as is peculiar to Lumpe, can attribute such a great importance to this circumstance, and if Lumpe is actually convinced that he sends a puerpera to the dead-house almost

every day because of this circumstance, exclusive of transfers and infants infected through the mothers, then I ask him how he defends the outrage he has committed by not once proposing such an easy remedy as the suppression of this factor?

However, the reader may compose himself, because with Lumpe there is no question of an outrage but only of his exact science, because Lumpe's service as an Assistant occurred before the

puerperal Columbian egg was discovered.

Lumpe's exact science considers admissions and the inability to ventilate as synonymous, consequently in lying-in hospitals which have daily admissions and not merely four admission-days a week, there can be no ventilation. However, we must stick to the two divisions in Vienna. I ask which division should be better ventilated, the Second, which had three admission-days weekly, and yet very frequently could not hold admissions on those days, because of overcrowding, or must give over again before the appointed days, or the First, which, although it had four admission-days weekly of its own, yet had always enough room to receive patients or take more than its share which should have gone to the Second Division?

The puerperae of the First Division get a different room every seven or eight days. I was at the First Clinic five years and never in that time was the lying-in ward filled with new puerperae without being aired for at least a day, (p. 452) not to mention the observance of other considerations of cleanliness

The two divisions of the Vienna Lying-in Hospital have stood side by side since 1833, i.e. for the 26 years up to 1859, and during all this time the First Division had four and the Second three admission-days a week, during the first eight years the average mortality in the First Division was 6.56% and in the Second 5.58%, on the average the First Division cared for 1246 more puerperae yearly. During the next six years, the mortality in the First Division was 9.92%, in the Second 3.38%, the number of puerperae cared for by the First was 375 more than in the Second. During the last 12 years the mortality was 3.57% in the First, 3.06% in the Second, 598 more puerperae were cared for yearly in the First Division

Can the inexorable Lumpe logic and the Lumpe exact science state, I wonder, the reason why the fourth admission day with only 375 more puerperae yearly has produced in six years a three-fold greater mortality in the First Clinic, while there has been no difference in the mortality of the two divisions with the same fourth admission day over a period of 20 years with 1246 and 598 more puerperae yearly? True logic and exact science on the origin and prevention of puerperal fever is in the position to give this reason

During the first eight years, medical students and pupil-midwives were assigned in equal numbers to both divisions, and consequently in both divisions infection came from all sources, hence a similar mortality in each. In the succeeding six years, infection from the cadaver ceased to a greater extent in the Second Division, but flowed more profusely from this source into the First Division, because of the assignment of all medical students to the First and all pupil-midwives to the Second Division, and hence the difference in the mortality, in the following twelve years the difference in mortality was done away with by the chlorine-washings

Dr Lumpe says. "Finally, I must still make some (p 453) serious objections to the assertion that puerperal fever does not occur in epidemic form outside the lying-in hospital From my practice I can enumerate a sufficient number of cases (as can many others along with me), where the disease as well as the rapid course and the incessant mortality showed the greatest similarity, indeed complete identity with those cases which occurred during a devastating hospital epidemic" I take Lumpe's word for it, that he had a sufficient number of cases of puerperal fever in his private practice, we have, of course, seen that Lumpe as Assistant provided a dead patient almost every day, and in 1850 after the puerperal Columbian egg was discovered in 1847 he finds that the pious longings of humanity cannot resist inexorable logic and exact science An obstetrician with such exact science must deliver over an adequate number of puerperae to destruction instead of escape

In case Lumpe is capable of reform, a time will come when he

must still admit to himself, if not to the world Semmelweis is right, how seldom do I now observe puerperal fever compared with the past

After Dr Lumpe said that the cadaveric poison for eight months was not poisonous, and that it then became poisonous again, for which he gives no analogy in the whole of nature, after he pointed out that the mortality was so much greater when the opportunity to contaminate the hands was much less and the mortality was so much less when the possibility for contamination of the hands was greater, after he proved that those most frequently examined died in lesser numbers, he drew the conclusion, that he had reduced my doctrine to an absurdity and that he would maintain for all eternity, that the examining finger impregnated with cadaveric poison was not the real thread on which the crystal of infection grows After Lumpe made all this clear, he says the following "If by all that has been said up to (p 454) now I disprove infection by cadaveric poison as the only and actual cause of puerperal fever, yet I cannot declare that the chlorinewashings are superfluous, because if among the many concurrent factors in the etiology of puerperal fever, only the least of them were destroyed, then the merit of the first introduction remains great enough Whether this actually is the case must be decided in time still to come

Until then, I think, we shall-wait and wash."

The reader sees the inexorable Lumpe logic in blossom, it is a great service he asserts, to have something absurd, Lumpe will maintain for all eternity that the examining finger does not produce puerperal fever. On that the future will decide. But will the future decide thereon, the future after eternity even? And how small is the factor causing puerperal fever which is destroyed by chlorine-washings, the reader will perceive from the fact that the many other concurrent Lumpe factors for the causation of puerperal fever have not once been able to kill one puerperae out of one hundred.

Dr Lumpe heads this essay with the motto "A way for the truth," the motto would be more in accord with his paper, if it read "Open road for deceitfulness"

As adherents of my views, there took part in the discussion Dr Chiari, Dr Helm, Dr. Arneth, and Prof. Rokitansky

Dr Chiari, Emeritus Assistant in the First Clinic, says. "The mortality of the First Clinic is dependent on the circumstances which have been exactly outlined by Dr Semmelweis"

The acting director of the General Hospital, Dr. Prof Helm, likewise Emeritus Assistant at the First Clinic, first answered the person who disputed my priority, and the other who considered my opinion as wholly unfounded, and then put the question for answer: How has it happened that for three years since the introduction of the (p 455) chlorine-washings, the former frequency of puerperal fever, the so-called epidemics, had ceased

Finally Dr. Helm declared every individual physician, as well as every medical association, is under great obligation to Dr.

Semmelweis for his discovery

Dr Arneth, Assistant in the Second Clinic, found that the difference in the mortality of the two divisions is due to the cadaveric poison, which is more frequently present in the First Clinic than in the Second

As a direct proof for the correctness of my views, the only one claimed by me, but which cannot and may not be yielded, Dr. Arneth considered must be represented by the case of carcinoma uteri (See p 58, line 3 from the bottom).

In conclusion, Dr. Arneth likewise declared that thanks are due to Dr. Semmelweis alone, because he has brought to light a new idea, but in addition, which was the main point, he had

brought it to a successful application and acceptation

Chairman Prof Rokitansky gave a resume of the principal points of the discussion and referred to the indisputable value of the calcium-chloride washings, which were even conceded by the opponents of Semmelweis' views

Dr Arneth gave a lecture before the Academy of Medicine in Paris on my views on the origin and prevention of childbed fever; as a result of this lecture, an investigating committee was appointed, which however failed, as Dr Arneth told me personally, to inform him of the results of the investigation, and when he

applied to the President of the Investigating Committee by letter, his letter went unanswered

The name of the President of this committee has escaped me and neither Dr Arneth nor I have seen a report of this committee. Scanzoni says in his text-book: "and in Paris, Semmelweis' discovery promulgated by Dr. Arneth (p 456) before the Academy failed to receive approbation," without naming his source

Carl Braun says. "The Academy of Medicine in Paris* in 1851 under the presidency of Orfila expressed itself with the greatest firmness against the theory of cadaveric infection, and in this connection pointed out that in the Maternité and in the Clinic of the Faculty for puerperal women in Paris, there are exactly the same conditions present as in both clinics in Vienna, that in both very violent puerperal fever epidemics occur and for chloride of calcium was denied every capability for the destruction of the cadaveric molecule"

Whether this judgement of the Academy applied to Arneth's lecture, or whether, even without the stimulus by Arneth, my views were judged, I do not know, because I myself have not been able to obtain the source in question through the bookseller, I know only for certain that Arneth did not mention Orfila to me as President of the Investigating Committee

The reader recalls what we showed on p. 128 etc., that the system of teaching midwives at the Maternité in Paris is so constituted that the midwives there are able to contaminate their hands as frequently as only physicians do elsewhere, and because of this the mortality of the Maternité is just as great as in Dubois' clinic, where physicians are trained. In Vienna, the pupil-midwives not only have nothing to do with cadavers, but they do not come in contact with the sick puerperae, because the pupil-midwives may not attend in the sick-ward of the Midwives' Division, only the Assistant and the Chief Midwife attend the visit of the Professor to the sick and to this circumstance is ascribed the better state of health among the puerperae in the Midwives' Division in contrast with the bad state of health (p. 457) among the puerperae of the First Obstetrical Clinic, as

^{*} Gazette des Hôpitaux, No 3, January 9, 1851 (Séances des Académies).

shown by Table No. 1. Therefore the Academy is in error when it believes that conditions in the Paris and the Vienna Midwives' schools are the same. In relation to puerperal fever, the conditions in both schools are essentially different, and therefore arises the actual difference in the state of health in the two schools.

In Dubois' Clinic and in the First Clinic in Vienna, the conditions in relation to puerperal fever are identical, and hence an identical mortality

That chloride of lime is not capable of destroying the cadaveric molecule, in 1847 and 1848 at the First Obstetrical Clinic in Vienna we unfortunately learned for the first time

The Academy of Medicine at Paris* in 1858 at its sessions from February 23 to July 6, once again took up puerperal fever for discussion, but the dry straw, which therein was brought to light, we shall leave unthreshed since there is no grain to be beaten out, we shall content ourselves with a dictum of Dubois, but first we shall state his scientific standing, as it was described to us by Arneth, p 67 "In obstetrics, the learned of France properly speaking do not constitute a republic, but a single man seems to rule All standards are dipped to him His opinion is sought for on all newly emerged phenomena Men who themselves have accomplished much, proclaim that their works are the fruit of his teaching, and advance his name when they believe an especially bold and offensive opinion to have been uttered against the French tradition Even in the Academy they listen breathlessly to his words, through him were gained for the French citizenry doctrines borrowed from foreigners (p 458) and up to now opposed by his country"

Let us learn now how Dubois, the summum forum obstetrician in France, criticizes my views. He says "Also the theory of Semmelweis so actively accepted in Germany and England, that the transfer through the blood, the discharges of the sick, even any matter in the processes of putrefaction, has not been established as true, and is probably already forgotten in the same school from which it came. Herewith, it most certainly should not be said that scrupulous precautionary measures are not therefore unnecessary, but only that the contagious nature is neither so

^{*} Monatschrift für Geburtskunde, October, 1858.

constant, nor so active, nor so persistent, as it must have been thought to be according to numerous reports. Were this actually so, the entire personnel of the lying-in hospital should be kept in the most stringent quarantine at any price, otherwise the public would be constantly in the greatest danger. For that reason, the exaggerated assumption should be traced back to their true significance. In a large number of women there no doubt exist conditions before delivery which are favorable to the development of puerperal fever, as frequently can be recognized in private practice and in the lying-in hospitals. Into the latter frequently come pregnant or parturient women with clearly marked signs of puerperal fever, which then develops very violently."

Thus spoke Dubois in 1858 Arneth says of Dubois in 1850, p 52 "Dubois met with a case, where a physician-friend of his, who was director of a small lying-in hospital in the country and who, after performing an autopsy, as seemed perfectly proper to him beyond all doubt, infected two women and saw them die Since then, Dubois paid women from the city to come to his clinic for the touching-exercises, (p 459) in order to keep those going into labor from being examined"

And French obstetrics is dominated by this unscrupulous man Poor humanity, to whom do you entrust your life?

My doctrine is not yet forgotten in the school from whence it came and the present essay will keep it from being forgotten in the future. My doctrine is only calumniated in the school from which it came, but it avenges itself as all honorable persons do on their calumniators, by reducing the mortality of this school, which formerly amounted to 992% in spite of the enormous numbers of transfers, to 371%, i.e. a reduction of about 621%; my calumniators certainly have to answer for the fact that my doctrine is no longer practiced. And this reverge puts a weapon into my hand, so that I can call out to my adversaries in the school from which it came, your own diminished mortality is your most convincing confutation.

Joseph Hermann Schmidt, Prof of Obstetrics at Berlin, says in an article,* "The Clinical Obstetrical Institute of the Royal

^{*} Annalen des Charité-Krankenhauses zu Berlin. Year 1, v 3 Berlin, 1850.

Charité," p 498 etc. "It cannot indeed be disputed that a normal labor, especially in a primipara, is often a very tedious process, and that it would be a superhuman demand on young men, if each one should remain in the lying-in chamber from the first membrane-loosening pains to the complete expulsion of the after-birth. In this connection it is of an advantage to have the lying-in hospital lodged with several other clinical institutes under one roof. (p 460) The students of obstetrics therefore go in turn into a medical or surgical clinic or into one of the special clinics and in the intervals return to the labor-room in order to observe the possible progress, or even go into the morgue, so that they may be quickly called if actual changes occur"

"They go into the morgue"

"These alternations between the two extremes of life, between the cradle and the bier, leads me to an episode, I refer to the observations and conjectures of Semmelweis, much discussed in the literature

"From my dear friend and colleague, Prof. Brucke in Vienna, received the following letter about this matter which I transmit to you word for word, because, as the whole world knows, he is not a credulous man, but a thorough-going investigator and his interest in the matter must constitute a fresh invitation to approach this important subject without the skepticism of Hume.

proach this important subject without the skepticism of Hume.

"In the lying-in hospital in Vienna for a number of years many puerperae have died of puerperal fever and particularly in the division which is visited by medical students, while the mortality in the division for the instruction of midwives is low. This mortality has been checked by Dr. Semmelweis, because he does not allow any student to examine during and after labor, until he has washed with a solution of sodium hypochlorite. He believes that many cases of puerperal fever are engendered because the students examine without having washed their hands carefully, after having participated in autopsies

"'It is indeed astonishing that the great mortality had ever appeared, since pathologic anatomy is studied zealously here, and that it should have stopped (p 461) in the Second Division, since this division is devoted exclusively to the instruction of midwives,

who do not do autopsies. The Academy of Science has now commissioned me to look into this subject, and allow me therefore in the interest of science and humanity to put the question to you, whether in your institution or that of Geheimrath Prof Busch any such phenomena have appeared, which are suitable to support the views of Dr Semmelweis'"

"To my sorrow I have not been able to offer Prof Brucke much more than my belief in the possibility.

"The only direct fact which I can add to these experiences,* was that extraordinary antithesis noted above in my previous and present obstetrical operations and their results †

*During my brief stay in Bade Lippespringe my successor, Dr Everken told me that childbed fever had prevailed in his lying-in institution just at a time when he had especially frequent opportunity for autopsies in the morgue, and, not knowing of Semmelweis' experience at that time, had taken no precautions, often conducting the pelvic examination for the student midwives on the pregnant women and women in labor immediately afterward. He also believed in the possibility. Naturally he later avoided such direct contact, also not forgetting the sodium hypochlorite solution.

† When I was transferred from my earlier private practice in Westphalia to my present sphere of activity, I soon noticed an unusual contrast between the ease and the results of obstetrical operations there and here The difficulties of a clinical teacher of obstetrics can not be compared with the much greater ones of a busy obstetrician of the Previously if I were called from my home city to a neighboring town, there was never any talk of a so-called time of choice for version Only the better and younger midwives recognized the abnormal positions of the child before the rupture of the membranes, all the older ones maintained that this was possible only after rupture of the membranes and that was early enough If the arm now presented with the outflow of fluid, the midwife demanded an obstetrician, but—the experienced wife of a neighbor knew better-for hours long it was attempted to see what the strength of the women could do, finally it was realized that the child was not to be obtained by the presenting arm. Now the council of elders decided for the obstetrician, the messenger hence, the obstetrician brought back after hours, and not infrequently an hour's work was necessary to do a podalic version in the narrow uterus contracted about the infant Naturally, the child was dead and the death of the mother was expected On the next day the husband appeared—to announce her complete well being and several weeks later, the mother herself to give thanks in the most friendly way!!-Thus who shall not believe that the uterus is an organ capable of maltreatment and still further ask "Who creates the strength of the female?" With my tender Berliners it is just the opposite Excepting for the rare cases which come in at the time of labor or in which version is necessary on the grounds of hurrying the labor, I have, in all versions, the time of choice or rather the choice of time The abnormal position of the child is diagnosed with great probability often during the pregnancy, always with certainty in the second stage of labor The cervix, dilated to the size of a silver groschen, allows one to feel the presenting shoulder, etc , through the relaxed membranes during an interval between pains Now one knows enough

(p 462) "At first glance one could say, that those Westphalian women in my practice have had the advantage over the Berlin women in the hospitals, (p 463) in that the cadaveric miasma never entered their vaginas during life, while here the indexfinger of the examining student carries it from the morgue more closely considered this hypothesis brings up the simple question, why then are the many normal puerperae proportionately so seldom attacked by metritis septica and the like, because they are examined just as frequently by students For that reason I believe that the nosocomial-atmosphere of the lying-in ward will stick to our reproaches, if after extraordinarily easy versions metritis or peritonitis appears the next day The relative contrast between midwives and accoucheurs has indeed existed here continually, but up to 1846 not in an especial spatial separation, besides close attention has not been paid to the mortality ratio of the two divisions, because Semmelweis was the first to direct our attention to this matter. He has made experiments on rabbits, for one would not dare to do them on human beings and just for that reason additional direct knowledge is impossible, above all Semmelweis even with the hypothetic etiology has brought forth the tolerably certain prophylaxis in the hypochlorite of sodium Everyone can, should and must disinfect himself with this, if he works on the viscera of the cadaver, before he introduces his hands into the viscera of the living. Every obstetrical clinic should make this moderate demand on its students from now on and make the opportunity easy therefor in its own wash-basins.

"As has been said, I believe in this possibility and the experi-

remains in the house, goes up and down, awaits patiently, not the rupture of the membranes, but the membranes ready to rupture, in order to carry out the version by Deleurye's method. If the spontaneous rupture of the membranes occurs before this maneuver, it is no misfortune, one is in the home previously prepared for the version. The version itself is a mere bagatelle, some of the attendants look at the clock, in one, two, or three minutes both feet are drawn down into the daylight, the expulsion of the child is left to nature, the afterbirth likewise follows it without difficulty, the delivered patient thanks you and feels excellent. The next day she has persistent pain in the abdomen, can not bear the pressure of a finger, she begins to vomit and gets ammonium carbonate and 30 leeches, is transferred to Schalein's or Wolff's clinic and there treated for the most exquisite metritis, peritonitis, etc. Here, where the uterus is not maltreated in the slightest, I believe it is the hospital atmosphere

ences in Vienna are entirely sufficient for me to recommend caution, I do not lay claim to such experiences for myself

"After all this way must be one of the many factors which lead to puerperal fever, but that it is not the only one is certain"

(p 464) To the foregoing, we make the following reply If Prof. Schmidt does not believe that the cadaveric miasma on the index finger of the examining student does carry puerperal fever to the women of Berlin, because the same finger does not also carry it to the normal parturient, then we cannot suppress our astonishment over such an assertion. Prof Schmidt says on p 491. "Since the medical supervision of the lying-in hospital was entrusted to me from September, 1844 up to May, 1850, inclusive, out of 2631 puerperae altogether 442 were removed to other stations, seven died in the first five days after labor, six after a longer period of time in the lying-in hospital itself. And that every puerpera was transferred as soon as suspected seemed to me to be the reason why the great destroying angel of the lying-in hospitals rarely visited the obstetrical department in the Charité"

Prof. Schmidt sends 442 out of 2631 puerperae to other stations, and in spite of the misfortune to so many hundred puerperae, he did not once learn that even normal puerperae frequently become ill with puerperal fever

The reader knows that as a result of unpreventable autoinfection less than one of 100 puerperae dies, consequently out of 2631 puerperae 25 at the most die as the result of autoinfection

If in the obstetrical department itself, 13 puerperae died, how many out of the 442 in the other stations may have died?

The death of so many puerperae was not sufficient to teach Prof Schmidt that the destroying angel of the lying-in hospitals insists on a bountiful harvest even in the Charité

Our astonishment mounts at the assertion of Professor Schmidt, that the nosocomial-atmosphere of the lying-in ward and not the cadaver of the morgue sticks to our reproaches, (p 465) if metritis or peritonitis sets in the day after extraordinarily easy versions; as though the normal puerperae, who according to Schmidt's assumption so seldom fall ill from puerperal fever, were not also exposed to the influence of the nosocomial atmosphere.

On such premises is it conceivable, as I have just learned, that in Berlin more puerperae died in the division for physicians than in the division for midwives

Prof Schmidt says as follows: "The relative contrast between midwives and accoucheurs has indeed existed here continually, but up to 1846 not in an especial spatial separation, besides close attention has not been paid to the mortality ratio of the two divisions, because Semmelweis was the first to direct our attention to this matter"

If Prof Schmidt therefore cannot offer any of his own experiences confirming my views to Prof. Brucke, then it is of no consequence that Schmidt has no opportunity to obtain experience, but it does matter that he is incapable of learning by experience. Prof Schmidt writes in 1850: "Everyone can, should and must

disinfect himself with this (chloride of lime), if he works on the viscera of the cadaver, before he introduces his hands into the viscera of the living. Every obstetrical clinic should make this moderate demand on its students from now on and make the opportunity easy therefor in its own wash basins, as has been said, I believe in the possibility and the experiences in Vienna are entirely sufficient for me to recommend caution, I do not lay claim to such experiences for myself." How prudent Prof. Schmidt was, and how truly he did not have experiences of his own, which he did not claim, is evident from a meeting of the Obstetrical Society held in Berlin on May 9, 1858,* as it is reported. "Prof Virchow communicated to the Society the results of his studies on the women, who become ill with puerperal fever at the Charité The observations include the period from the spring of 1856 up to now During these 18 months, there occurred 83 deaths during the puerperium, of whom however no small part were removed from the department Even if it is not difficult to demonstrate an outbreak of the disease in groups, yet one cannot still speak of a circumscribed epidemic, because the Charité unfortunately has produced single cases almost continuously in the period designated, and each month delivered its con-

^{*} Monatschrift für Geburtskunde und Frauenkrankheiten. Berlin, 1858. V 11, part 6

tingent of fatal cases. Meanwhile the two winter semesters were distinguished by the greater number of deaths, and of these in particular the winter 1857–1858, when November with 20 deaths seems to correspond to the most dangerous month of the height of the epidemic"

Twenty deaths correspond to an estimate of 2,000 births I do not know how many deliveries occurred in November, 1857 in the Charité, I know only that the size of the mortality increases in the same proportion in which the deliveries, which actually occurred in November, deviate from the number 2,000 Such a shocking prodigality of human life occurred in Berlin, after it had already been learned from Vienna how puerperal fever may be prevented And Professor Schmidt has not had any experience and does not claim any of his own.

On page 523 Professor Schmidt says: "Before I die, I hope yet to write in extenso on my obstetrical mistakes, there is no lack of histories of obstetrical successes" I hope that Professor Schmidt will not limit himself to his obstetrical mistakes in respect to labor I expect that he will also surrender to the world his post-partum errors in connection with puerperal fever, in order that his good example, which he will give thereby (p 467) to other accoucheurs, may do good for humanity against which he has sinned I have inquired from Dr. Everken by letter, whether he, since he has avoided such directness, has not also forgotten the sodium hypochlorite solution, and whether since this time he has seen puerperal fever less often I received the following answer:

"Most Honored Colleague!

"The statement published in *loco citato* by Medical Councillor Dr Schmidt on the outbreak of puerperal fever in the lying-in hospital under my direction is founded on facts, the etiological connections of which have a probable basis, if not one also of certainty

"Single cases of puerperal fever occurred repeatedly, while an extension of the same occurred among the puerperae, I must admit that during the outbreak of the disease a situation has occurred, which is put forward by your communication as a causative factor. From time to time I have autopsied cadavers in

the morgue of the hospital to which this lying-in hospital belongs. It did not occur to me to propose this circumstance as the only cause, but it did keep me from making any examinations of gravidae, parturients and puerperae following autopsies. There were no further cases of puerperal fever, but I must add that shortly thereafter, following an extension of the disease, the lying-in hospital was separated from the general hospital so that even a sporadic case has not occurred since—

"You will concede, most honored colleague, that it is difficult to make a decision and that the conclusion post hoc, ergo propter hoc is perhaps nowhere more deceptive than in medicine

(p 468) "I have no objection to any use you may make of the

foregoing communication

With the highest esteem, Your most devoted,

D Everken
Director of the Royal

Midwives' Institute."

Paderborn, Feb 17, 1858.

I do not class the Paderborn Royal Midwives' Institute among those lying-in hospitals in which my doctrine has been proven, and I am very thankful to my most esteemed colleague for the good advice which he gives me But I cannot make use of it at present, because I persist in saying, post contact with decomposed matter, ergo propter contact with decomposed matter much puerperal fever, post introduction of the chlorine-washings less puerperal fever, ergo propter introduction of chlorine washings less puerperal fever

In the future, however, this advice of my most esteemed colleague shall be the standard of my conclusions as a protection

against deception

Rudolph Virchow in his "Collected Papers on Scientific Medicine," Frankfort-on-Main, 1856, p 737, says as follows "Natural science knows no such bogey-man as the fellow who speculates" Boer formulated the same truth as follows. "Were so observing a physician as Hippocrates created only once in a century, instead

of so many fabricators of systems, how much better off would be mankind and the animal kingdom in general."

Boer, the author of seven books on natural obstetrics, had the

right to speak.

Bur Virchow, who is himself a bogey-man for natural science by reason of his many speculations and such a bad observer that as a pathological anatomist even in 1858 he does not yet recognize the symptoms of an absorption fever in the post-mortem findings of puerperae (p 469) dead from childbed fever, Virchow has no right so to speak, unless in a humorous manner he has so characterized himself in a moment of jovial sincerity.

In this work we must naturally limit ourselves to the speculations of which Virchow has been guilty in connection with puerperal fever

The statement of Virchow that natural science knows no bogeyman like the fellow "who speculates!" stands in the midst of speculation, i.e., it stands in an introduction to a rather long series of reports on puerperal diseases, which he intended to deliver, but has not, in this introduction are discussed menstruation, conception and pregnancy, as things which have an etiologic relationship with puerperal fever

The anatomist, the surgeon, the surgical patients, the newborn whether male or female, who die of puerperal fever or pyemia, according to my interpretation, have never menstruated, have never conceived, have never been pregnant, and yet died of the same disease from which the puerperae die, and my doctrine, which has shown the way to limit puerperal fever to less than one dead puerpera out of 100, is not based upon the art of causing menstruation, conception and pregnancy to stop.

Pregnancy provides nothing but the absorbing surface for puerperal fever, but it has provided no absorbing surface in the anatomist, the surgeon, the surgical patients and the newborn whether boys or girls, and puerperal fever occurs nevertheless, in puerperae, the absorbing surface produces no puerperal fever, if this surface is not contaminated with decomposed matter, and how unnecessary the internal absorbing surface is for the production of puerperal fever is evident from the fact that the least injury (p 470) to any area on the male or female body makes the disease possible.

Virchow says. "For the occurrence of puerperal fever epidemics two circumstances are of fundamental interest, the climatic conditions and the current morbidity. In the first instance, it seems that the majority of epidemics occur in the winter months

Among the current forms of morbidity along with the acute exanthemata belong particularly widespread erysipelatous, croupous, ichorous and purulent inflammations"

It is wholly true that the great majority of epidemics occur in the winter months, not because of the climatic conditions in winter, but because winter is preeminently the time for contact with decomposed matter. For proof that climatic conditions exert no influence upon the production of childbed fever, Table No. II, p 9 and Table No. XIX, p 120 will serve

It is likewise correct that puerperal fever exists concurrently with acute exanthemata, with widespread erysipelatous, ichorous, purulent inflammations, and the cause of this contemporaneous occurrence is that such diseases are treated and cared for by physicians and midwives, who also treat and care for gravidae, parturients and puerperae.

Should the two tables cited not convince Virchow, then we tender him the advice that he may intercede with his Minister of Instruction to have the obstetrical instruction suppressed for as many months as may be necessary to convince Virchow of the continued healthy condition of the puerperae in the winter-time, and that climatic conditions in winter do not engender childbedfever, the objection that the obstetrical instruction need not be suppressed, I cannot allow, because obstetrical instruction, (p. 471) which is so constituted, that Virchow, although we have come to know him as a wretched observer as far as puerperal fever is concerned, could make the observation that the greatest number of epidemics occur in the winter months, that along with erysipelatous, croupous, ichorous and purulent inflammations coincident puerperal fever epidemics occur, an obstetrical instruction which is so constituted, that in 1858 Virchow could talk before the Society for Obstetrics in Berlin on puerperal fever epidemics with only a single voice raised in opposition against him, such an obstetrical instruction is so thoroughly bad that it must be suppressed if it can thereby be purified.

How then could the obstetrical instruction in Berlin be other than bad, if Professor Schmidt believes in a nosocomial

atmosphere?

Prof Crede* is an epidemicist and as confirmation of his teaching sent 58 out of 336 puerperae in 1854-55 to other stations, there to die: his removal to Leipzig in his opinion has changed nothing, in Leipzig 20 out of 594 puerperae died in three years.

Busch's successor, Professor E. Martin† has convinced me by his lecture given November 9, 1858 before the Society for Obstetrics in Berlin "On Tubal Inflammation and the Overflow of Purulent Secretion into the Abdominal Cavity as a Cause of Abdominal Inflammation among Puerperae" that the puerperal sun, which rose in Vienna in 1847, has not yet illuminated his soul.

(To be Concluded)

^{*} Annalen des Charité-Krankenhauses. Year 8, No. 1, 1857. † Monatschrift für Geburtskunde. V. 1, No 1, 1859

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MEDICAL CLASSICS

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The Etiology, the Concept and the Prophylaxis of Childbed Fever. IV

BY

IGNAZ PHILIPP SEMMELWEIS

Doctor of Medicine and Surgery, Master of Obstetrics, Professor of Theoretic and Practical Obstetrics at the Royal Hungarian University in Pest, etc., etc

Pest, Vienna and Leipzig
C A Hartleben's Verlags-Expedition

1861

Translation By Frank P Murphy, AM, MD
Associate Professor of Obstetrics, Creighton University School of Medicine

THE PUERPERAL THROMBOSES

Puerperal thromboses exist as a physiological condition only in the speculations of Virchow, but not (p 472) in the uterus of the puerperae, in pathologic states they exist, to be sure, as the product of the blood disintegrated by absorbed decomposed matter, as do all other localizations, such as peritonitis, endometritis, etc, etc, etc

Virchow believes that the contractions of the uterus after the separation of the placenta are not sufficient to prevent a hemorrhage, and that a physiologic puerperal thrombosis causes a complete closure of the vessels The uterine contractions after the separation of the placenta are of themselves alone completely

sufficient to prevent hemorrhage, so that not only are the lumina of the vessels contracted by the uterine contractions, but at the same time by the shortening of the long axis of the uterus the distance is diminished which the vessels traverse, and thereby the course of the vessels becomes more tortuous, an invagination of the vessel wall into the lumen is brought about, and the valvular mechanism so produced causes a complete closure of the vessels. This happens in the moment of the contraction, as for the clotting of the blood at high temperature, in such a temperature all puerperae would bleed profusely

That puerperal thromboses do not exist in physiologic states, autopsies prove, although Virchow, in order to prove the contrary, refers also to the autopsies, it now becomes evident who is a bad observer. If a puerpera does not die as a result of puerperal fever, then thromboses are never found in the uterus, if a puerpera dies of puerperal fever, then thromboses can be found in the uterus as a result of the disintegration of the blood by the absorbed decomposed matter, or they may not be found. If a thrombosis actually does not occur, there are still so many vessels free of thrombi that hemorrhage could occur from these thrombus-free vessels.

Since puerperal thromboses do not occur in a physiologic state, then even the physiologic puerperal thromboses cannot thereby become the cause of puerperal fever as a result of the putrefaction (p 473) of the physiologic thromboses under certain conditions

That puerperal fever does not originate in this manner is proven by the fact that my doctrine, which teaches how to limit puerperal fever to less than one dead puerpera out of one hundred, is not based upon measures which are capable of preventing the formation of physiologic thromboses or the breaking down of physiologic thromboses into pus

In order to prove that the physiologic thromboses lead to puerperal fever, Virchow says. "The better the uterus is contracted, the more favorable are the conditions for the uterine vessels and vice versa, the danger is always somewhat greater if the contraction is incomplete. The best observers are agreed thereon that in metrophlebitis the uterus usually remains enlarged." It is indeed true that in metrophlebitis the uterus remains in an enlarged state, but the persistence of the enlargement is not the cause of the metrophlebitis, but on the contrary the metrophlebitis is the cause of the enlargement of the uterus, just as the puerpera does not have peritonitis for the reason that she has meteorism, but has no meteorism because she has peritonitis

That the faulty contraction of the uterus does not lead to physiologic thrombosis and this in turn to puerperal fever, but that the faulty contraction is the result of the metrophlebitis present and this in turn is the localization of the blood disintegration by the absorbed decomposed matter, (p. 474) is proven by the fact that the metrophlebitis can be prevented by the chlorine-washings of the hand, by the chlorine-washings of the hand will be destroyed the decomposed matter, which has engendered the puerperal fever in the genital organs. How would the formation of the physiologic thromboses be prevented by washing the hands in chlorine solution? How would washing the hands in chlorine solution prevent the metamorphosis of the physiologic thromboses which leads to puerperal fever?

What sort of high comedy will be brought to light if several people give opinions upon a subject which they do not understand? In this connection, I have occasion to cite an example

The reader knows that Virchow is of the opinion that the more deficient the contractions of the uterus and of the blood-vessels which encompass the uterus, the greater is the danger of the formation of a physiologic thrombosis and the transition of the thrombosis into puerperal fever and vice versa In order to bring about a good contraction as required, as Virchow says. "in all probability, a special nervous influence, and it may be in particular the appearance of lactation on time, above all milk-fever, has in this connection a great influence, while all paralyzing and weakening influences, as they have a very harmful effect on the contraction of the uterus itself, interfere seriously also with the contraction of the blood-vessels Perhaps it may be explained in this manner, ie that just as with patients delivered at home, in whom such a great agitation of the nervous apparatus takes place, dangerous incidents seldom occur, while we see them

happen so often among feeble women in spite of the best of care and even more so in overcrowded lying-hospitals under miasmatic influences "

Virchow believes also that lactation and a great agitation of the nervous system prevents puerperal fever

(p 475) Kiwisch says. "With regard to the milk-secretion, I have learned that non-lactating puerperae were attacked less often during the epidemics than the nursing mothers. Thus in the Prague Lying-in Hospital the number of sick patients in the division for pay-patients, where no puerperae nursed her baby, was less in comparison with those in the division for nursing mothers."

Scanzoni even finds in the nervous agitation the cause of the greater mortality in the teaching institutions for accoucheurs than in those for midwives And Prof Braun is of the same opinion.

The women delivered at home and the pay patients in Prague rarely become ill because they are not used for teaching, consequently are not infected; in teaching hospitals for accoucheurs, the patients are more frequently infected than in teaching hospitals for midwives, hence the more unfavorable state of health in the former

The articles which have appeared since 1847 on puerperal fever, have made me happy all the more, when I learned that here and there my views have proven true, but my happiness was disturbed when I observed that in spite of success the matter was still in doubt, and my indignation was aroused when I saw how incompetency, dishonesty, and unscrupulousness put on airs, and long mortality lists drew from me heavy groans, but these articles are acceptable because occasionally they stimulate my muscles of risibility to activity, more than would a Nestorian joke

Virchow spreads error throughout the world not merely on his own responsibility, but also lends the authority of his name to alien mistakes. Virchow has made his own the error on which Prof. Veit in Rostock feeds in regard to puerperal fever, in that he has included a treatise on puerperal fever in his "Handbook of Special Pathology and Theory," in which he contends for the epidemic theory and against my doctrine on (p. 476) the origin of puerperal fever. I cannot here refute again the doctrine of

epidemic puerperal fever, just as I cannot here prove again my doctrine, because I must transcribe the present work once more, we content ourselves with a simple appelation to this essay, that the truth stands by my side and error on the side of Virchow and Veit

Only to the declaration of Veit "that the fatal curse of the Vienna Lying-in Hospital furnishes an alarming example," do I refer with all the indignation of which I am capable tality in the Vienna Lying-in Hospital was no more alarming than at other institutions in which similar conditions prevail, and for a misfortune which arises out of ignorance, no one can be made responsible But the frightful mortality of the Vienna Lying-in Hospital has led to the discovery of the doctrine which shows how puerperal fever may be limited to the death of less than one puerpera out of 100, while a similar frightful mortality in other places has had no other result than the filling of the dead-house By what right does Veit speak of the frightful mortality of the Vienna Lying-in Hospital, the same Veit, who in 1855 still opposes my doctrine, the same Veit, who ascribes this frightful mortality to atmospheric influences beyond our powers and thereby condemns the puerperae for all eternity to this terrible mortality?

By what right does Virchow lend the authority of his name to this declaration, the same Virchow, who indeed has not yet attacked my doctrine because he ignores it in his supreme vanity, and for this reason is so set in such ignorance of the origin, the concept and the prevention of puerperal fever that in 1858 he could lecture before the Society for Obstetrics in Berlin on puerperal disease (p 477) in the Charité, in which he let the epidemic reach its extreme height in November with 20 deaths, without even suspecting what a terrible and at the same time what a criminal mortality this might be, a mortality which occurred twelve years after it had been taught in Vienna how this mortality as the result of puerperal fever could be limited to less than one death out of 100 puerperae?

Since 1847 there is nothing more terrifying for me than the desperate condition in which obstetrical instruction still finds itself in the preponderant majority of obstetrical institutions of instruction

What a terrible state exists in relation to puerperal fever in Berlin, we have just had opportunity to describe

Not to mention my students, 1 e the medical men and surgeons, up to now 823 female students who have been trained by me as midwives for obstetrical practice in Hungary, who know better than Virchow why the great majority of puerperal epidemics occur in winter, who know better than Virchow what to do in order not to have concurrent puerperal fever, when patients with erysipelatous, croupous, ichorous and purulent inflammations are committed to their care, who in their enlightenment as members of the Society for Obstetrics would laugh at Virchow, if he would lecture to them on epidemic puerperal fever.

(p 478) ON THE INVESTIGATION OF THE CAUSES OF EPIDEMIC PUERPERAL FEVER

Reported by Prof Dr Anselm Martin,* Director of the Royal Lying-In Hospital, Munich

A deplorable drawback to the recently and entirely newly erected Lying-in Hospital in Munich is created by the appearance of epidemic puerperal fever, which has been fought with but brief interruptions from the middle of December, 1858 to the end of June, 1857

The figures are as follows From October 1 to the end of July, 1090 patients were cared for in the lying-in hospital. Of these there fell ill, recovered or died from puerperal fever and kindred pathologic manifestation (metritis, phlegmasia alba dolens, phlebitis brachialic, etc.)

	Sick	Recovered	Died
In Obs Dept Transfers In Gen Hosp dismissed from Obs Dept	43 ¹ 40 5	30 14 3	13 22 2
	88	47	37

¹⁴ still under treatment

^{*} Monatschrift fur Geburtskunde V. 10, No 4, Berlin, 1857

It is a fact well worth remembering, that one usually designates the unfavorable location of the lying-in hospital, overcrowding, lack of cleanliness, etc as some of the outstanding causes, but the affliction comes to light in a building newly constructed from the ground up and occupied for the first time just a few months previously, everywhere dry, clean and declared habitable by the sanitary and building authorities

Accessible to light and air from all sides, roomy and answering every requirement, the entire building was furnished with completely new equipment, particularly in all parts of its internal fittings. The spacious (p. 479) and entirely separate lying-in wards contain only six beds, with these wards and their beds a continual change goes on, even whole wings of the great structure are left unused and isolated for long intervals, along with the entire wing, all beds etc., etc., are completely cleaned and aired.

In general, every conceivably possible exciting cause of the disease is sought out, watched over and contended against day and night not only with the utmost attention and vigilance, but even with most laborious scrupulousness in the structural and internal organization as well as in the service of the house, even in every individual cared for Likewise almost all sick patients are sent to the general hospital, only those few who cannot well be transferred were treated in the lying-in hospital

Cadavers are removed from the institute after some hours. The patients are treated in the best equipped and isolated sick wards under special care. The attending personnel of the sick are assigned to them only, and may not enter the premises where the healthy patients are lodged, nor live in common with the other attendants of the ouse. The laundry from the sick wards is sorted out, washed and used for the sick patients only after scrupulous washing and airing. Enema syringes, catheters, etc for the sick wards are used in these wards only and are always carefully cleaned and put away separately. Even the physicians visiting sick patients must always wash their hands with chlorine-water on leaving the sick-ward, all patients in the entire house are subjected to an assiduous attention day and night in daily regimen, cleanliness, diet, etc., and in this are watched over every hour

Physicians from this country and abroad who visited the institution during the epidemic and came to know all these arrangements, regulations, and all the supervision, (p 480) according to the general statement, would scarcely believe that, with the existing combination of auspicious conditions so seldom found in a lying-in hospital, yet an epidemic of puerperal fever appears, and that such a thing should ever be possible in this institution in particular. The symptoms, the course, etc., of the disease were the well-known ones with a prevailing adynamic character, the typhoid form in the majority

Epidemic puerperal fever has already been written up in the greatest detail in the literature. It is not the intention here to consider once more the variants already long well known. Though a high value may be placed on this literature, the disease has not become less common, the statistics more pleasant nor the therapy more successful

It should therefore be the utmost obligation of the larger lying-in hospitals to report from time to time and more often than formerly these facts which have been collected in the search for the more probable causative factors. The information is yet defective on this subject. Not many lying-in hospitals offer similar material, definite observations are not possible at all times and very few lying-in hospitals enjoy an auspicious location, etc. Even under these conditions we now believe we should be able to present from the newly erected lying-in hospital in Munich some contributions to the further investigation of the etiological factors with the wish that they may be tested and evaluated wherever possible

At this point, we have the following to reply. The time for the search after the etiological factors for childbed fever is over, because the only etiological factor for all cases of childbed fever, no single case excepted, was discovered in the decomposed animal-organic matter. The time has now arrived for the struggle to render harmless this single (p 481) factor for childbed fever, in order that the disease may become rarer within and without the lying-in hospitals all over the world, in order that its statistics may become more gratifying and in order that its therapy may

become more auspicious in the sense that one may have the

opportunity to be unsuccessful less often

We have stated at the proper points in this essay in what places the disease has already become actually rarer, its statistics more gratifying and its therapy more auspicious in the sense that one may have the opportunity to unsuccessful therapy less often, as a result of the campaign against the decomposed animal-organic matter

After we recognize in the decomposed animal-organic matter the only cause of childbed fever, we shall ignore the other etiologic factors for childbed fever, as such are alleged by Prof Martin as not being causative factors for childbed fever, and mention only what he says of the cadaveric infection

It is acknowledged that it is designated as the cause of childbed fever especially in lying-in hospitals and will be accepted by some as such. The cadaveric particles adhering to the hands of physicians and students (after examinations or exercises on the cadaver), or the cadaveric odor clinging to them even after washing with soap and water, should, just as putrid air permeates, have the property of engendering the puerperal process. Even the cadaveric odor on clothes, linen, etc. should have caused the infection

If even after many scientific tests this engendering cause will not be accepted, then we believe still, and without inclining moreover to one side or the other, the following facts should be mentioned

(p 482) After no important illnesses appeared among the puerperae of the lying-in hospital in January and February for a rather long time, two puerperae suddenly fell ill on one and the same day with the symptoms of epidemic puerperal fever

Both had delivered on the same day and almost at the same hour, for both there was not any known cause whatsoever for the sickness to be found in the entire hospital

In this so extraordinary event it was finally learned through continued investigation, that an Assistant had performed, unknown to the hospital authorities, an autopsy on an infant cadaver in the isolated autopsy room of the hospital According to his

statement, he had carefully washed with chlorine-water, but had examined only these two parturients immediately thereafter.

Because the two women became ill unusually soon after labor

Because the two women became ill unusually soon after labor and only these two out of all the puerperae, the culprit confessed that he had done the same thing in December on the day of the first appearance of puerperal fever in the lying-in hospital However at that time only the one examined by him after the autopsy became ill at first

Several more or less severe cases of puerperal fever soon followed the morbidity caused by cadaveric infection in December and the middle of February. It spread rapidly all over the house A bad state of health among several puerperae appeared further, and it required a period of 16 to 21 days until finally again happier conditions were to be seen.

To these events must yet be added the fact that the university obstetrical clinic of the Munich Lying-in Hospital was held daily from 10 to 11 o'clock in the morning, that into the clinic a large number of practitioners came directly (p 483) from the hospital medical clinic which was full of typhus sufferers, or sometimes even from the dissecting-rooms, that the delivery room, as well as the lying-in wards of the clinic gave off the reek of the dissecting-room, that even some practitioners came in contact with cadaveric particles at the autopsies and this condition was impossible to prevent or guard against.

Further it is necessary to recall that up to now the Munich Lying-in Hospital has in its register notations of the epidemic puerperal fever which has appeared in the institution, only during the existence of the obstetrical clinic and only since this was combined with it (since 1824) and the earlier, very exact lists scarcely mention this disease. In addition, the practitioners who resided in the house frequently studied pathologic anatomy along with their microscopic as well as chemical investigations, and they were called in a hurry from these studies to examine the parturients, etc., also precise supervision of these examinations as is well known must be considered as in the realm of impossibility. Moreover it may be stated, that all these conditions

existed in the previously occupied locale during and along with the dangerous conditions in the house without the appearance of epidemic puerperal fever

As a result of the order of the government, the University obstetrical clinic was closed from the beginning of April to June 22 The morbidity has indeed not stopped, but has become less fre-

quent and less severe

With the beginning of the more favorable season of the year

(the beginning of June), it has entirely ceased

"As the clinic was again attended by students in July, there appeared again some rapidly fatal cases of the disease However the disease has again stopped, as the clinic is no longer attended by the students because of the close of the semester tion (p 484) between the infection and the students is not to be admitted in these few cases They appear to be sporadic cases, which frequently appear at the close of an epidemic"

These observations speak so plainly in themselves that comment is unnecessary I assume that the students were urged to wash their hands in chlorine-water before every examination, although it is not expressly so stated

The lying-in hospital in Munich is a convincing proof that, in spite of excellent accommodations, there will be no complete safety for lying-in hospitals as long as the law proposed by me to all governments, 1 e 1t should be explicitly forbidden for anyone of the personnel of the lying-in hospital to have any contact with decomposed matter, is not put in practice to the fullest extent.

Is it justifiable to make the favorable state of health in a lying-in hospital dependent upon the good will of the students? Cannot the thoughtlessness of a single person cause the greatest harm even with the best of intentions?

Carl Braun,

my successor in the Assistancy and the present Professor of Obstetrics in the First Clinic in Vienna, the same clinic from which came the convincing data which caused me to recognize the etiology of childbed fever accepted up to now, and at which I

discovered the eternally true etiology of this disease, is an opponent of this eternally true etiology * For this reason, the reader may be inclined to ascribe a greater weight to his opinion than to every other one of my opponents (p 485) and we are duty-bound therefore to set about the fundamental refutation of Carl Braun, as we have done with our previous adversaries, but Carl Braun makes the task easy for us. He says silly things in such rapid succession to the extent that we are apprehensive lest we lay ourselves open to the suspicion of not having given a true statement of his opposition, if we give only the sense of it, as we have done for the greater part with our other opponents, in order to protect ourselves against this suspicion, there is nothing else to do but to give his opposition word for word

Carl Braun's opposition to the eternally true etiology of childbed fever discovered by me originates not from a conviction that this etiology is not true, but is based in part on his ignorance of the most important precepts of my etiology, in part on his ill-will

the most important precepts of my etiology, in part on his ill-will Does it not point to ill-will, if Carl Braun states my propositions in very many places, and then opposes the same propositions in the clinic for 12 papers and in his text-book for 4 papers?

In the critical examination of Carl Braun's opposition, we shall refer to a few of these places as sufficient examples for the present. Carl Braun says in connection with the prophylaxis of childbed fever (Clinic, p 533, Text-book, p. 971)

"Since puerperal fever or pyemia is engendered by the inoculation with cadaveric poison, and by transfer of septic exudates,

"Since puerperal fever or pyemia is engendered by the inoculation with cadaveric poison, and by transfer of septic exudates, just as contact with patients suffering from one of the various zymotic diseases such as typhus, cholera, scarlet fever, measles, etc can spread these diseases, it is therefore the strict duty of the physician to see to the rigid isolation of healthy puerperae from those ill with a zymotic disease, in private dwellings as well as in lying-in hospitals, and never to examine or operate on a gravida, (p 486) parturient or puerpera, if an assistant had any contact a short time before with cadaveric particles or septic exudates"

Lehrbuch der Geburtshilfe von Braun Wien, 1857

^{*} Klinik der Geburtshilfe und Gynaekologie von Chiari, Braun, Spaeht, Erlangen, 1855

And in the "Clinic for Obstetrics and Gynecology," Carl Braun adds in a note "It is therefore a praiseworthy precaution on the part of every clinician to have the clinical examinations done in the earliest morning hours before there is any sort of contact with cadavers" Can Carl Braun oppose me with the conviction that my doctrine is false?

From the table, No XXIV, which may be found in the present work on p 142, the reader will perceive that during the first 39 years of the existence of the Vienna Lying-in Hospital the mortality before medicine was on an anatomic basis amounted to 125% After the adoption of the anatomic principles, the mortality rose in the next ten years to 530%

The lying-in hospital was then split into two divisions and to each division medical students and pupil-midwives were assigned in equal numbers The mortality in the First Division rose in the next eight years to 6 56%. After the assignment of all medical students to the First Division, the mortality rose in the next six years to 9 92% By the introduction of the chlorine-washings about the middle of May, 1847, in the First Clinic, the mortality was decreased to 5 04% and in 1848, when the chlorine-washings were supervised by me throughout the entire year, the mortality sank to 1 27% In the next five years during which Carl Braun was Assistant and in addition the year 1858, in which Carl Braun was Acting Professor in this clinic, there occurred 24,692 births, out of which there died 613 patients, or 2 48% The mortality decreased therefore in contrast with the six years in which there were no chlorine-washings at the clinic for physicians, about 744%, or with other words, (p 487) had not the chlorinewashings been introduced, then the mortality at the clinic for physicians would have increased to the same extent it would have done during the six years without the chlorine-washings, consequently there would have died 2450 women, but since 613 patients died, 1837 lives have been saved in these six years as a result of my doctrine on the origin and prevention of childbed fever these figures are lacking the infants, who would have had the childbed fever communicated to them by 837 patients, who were saved

For better orientation, I inform the reader that Carl Braun abandoned the chlorine-washings long, long ago, and instead advised his students not to make examinations as long as the hands gave off the cadaveric odor Is this not ill will, if Carl Braun traduces my doctrine which saved for him 837 mothers in six years? Not to mention the infants saved? To be sure, during these six years my doctrine has not accomplished what it is capable of doing Or in other words in these six years there occurred not only cases as a result of auto-infection but also 367 cases of preventable infection from without, since from among the 24,692 puerpera 617 of them died And if we attribute ten yearly cases of infection from without to the unfavorable conditions at the First Obstetrical Clinic, because we certainly could not prevent these ten cases of infection from without, there still remain for the six years 317 mothers and the infants infected from those mothers, who fell victims to the ill-will of Carl Braun, because he against his better conviction wrote not only in opposition to my doctrine on the prevention of childbed fever but thereby has misled his students into the most dangerous indiscretions And what harm will these students, so badly taught by Carl Braun, do out in practice? (p 488) The ghastly accomplishments of one of his pupils we can verify in all their horrible circumstances Gustave Braun, Carl Braun's pupil, brother and successor in the Assistancy, during his four years as Assistant lost 878 out of 16,197 puerperae from puerperal fever, 1.e 161 from auto-infection and 717 as a result of preventable infection from without, and how great must be the number of infants, who were infected by these 717 mothers and must have died likewise from puerperal feverl

However, let us hear what Carl Braun has to say in the "Clinic for Obstetrics and Gynecology" According to him, there are 30 causes of childbed fever, the twenty-eighth is the cadaveric infection. Of the latter, he says as follows. "In 1847 Semmelweis sought to establish as the most outstanding, in fact the only cause of childbed fever the theory of cadaveric infection, according to which the cadaveric particles, adhering to the hands following examinations or exercises on the cadaver, or the odor remaining

fixed on them as a putrid emanation, after washing with soap and water, have the ability to cause the puerperal process during the internal examination of the parturients. Semmelweis found a supporter in this matter in Professor Skoda!!" The reader sees how badly Carl Braun has used the opportunity which was offered him to learn something, because he knows only one source of the decomposed matter, i.e. the cadaver, and only one carrier of the decomposed matter, i.e. the examining finger, and how sacred the truth is for him is evident from the fact that in the literature he finds ten opponents along with the Academy of Medicine in Paris, but only a single advocate

The only cause of childbed fever is the decomposed matter, but not the decomposed matter alone, which comes from the cadaver, the reader knows that there are three sources of decomposed matter, and some infections will come more from one source, (p 489) others from another In Vienna, it was undoubtedly the cadaver, from which infection came most frequently, before 1823, there were also medical and surgical departments The reader knows, to what extent the mortality in the Vienna Lying-in Hospital rose after this year as a result of the anatomic trend of In the St Rochus Hospital at Pest it was the decomposed matter from the surgical department by which most infections were caused, at the obstetrical clinic in Pest on two occasions it was dirty linen from whence the infection came, from Prague Chiari relates that two parturients, whose genitals secreted an ichorous discharge during labor, caused two epidemics of puerperal fever, etc. etc

The carrier of the decomposed matter is not only the examining finger, but every object which is contaminated by decomposed matter and comes in contact with the genitals of the patient

For proof of his views, Semmelweis advances the following propositions

a) The mortality among the puerperae in the Vienna school in which physicians, who study pathologic anatomy, are instructed, is constantly much larger than in the school for midwives

b) Washing the hands of the physicians before the examination of the parturients with a solution of calcium chloride destroys all

the cadaver odor remaining on the hands and is a protective agent against the puerperal processes, if obstetrical examinations must be done after exercises on the cadaver

On these two points, Carl Braun replies as follows. To a) and b) During the winter of 1849 in spite of the recommended chlorine-washings there raged a puerperal fever epidemic, which ceased in April in the more favorable season of the year without ascertainable cause. In the summer semester there were only 29 deaths (p. 490) out of 1818 deliveries, i.e. 1.5%, although the teaching was carried on by the clinical director, Prof. Klein, without interruption and the operative exercises on the cadaver were diligently practiced by the students under the supervision of the Assistant.

In the winter semester 1849-50 puerperal fever broke out violently as usual, so that out of 1888 obstetrical cases there were 77 deaths, 1 e 2%.

These phenomena must substantially affect the belief in the protective power of calcium chloride

Because following Semmelweis' proposal a solution of calcium chloride was used in an open vessel (basin), in which all the students in attendance immersed their hands and had to scrub with a nail-brush, the more gypsum there was found in the sediment the weaker become the odor of chlorine in this disinfection water, so a glass jar equipped with a spout and a cover was brought into the labor-room, in which a fresh solution of chloride of lime was put before the visit, so that every student before or after every examination washed his hands with pure water reeking with chlorine. Along with the most conscientious and allembracing disinfection of every examining hand the epidemic from January to March increased from 3 9% to 5 0%

With the approaching summer semester of 1850, the puerperal process ceased, so that out of 1725 labor cases there were ten deaths, 1e 05% Since the decomposition of the cadaver goes on more rapidly in summer than in winter and the cadaveric odor clings to the hand longer after the operative exercises, so it was observed that after repeated examinations and cleansing the hands with chlorine-water, the odor was not destroyed on the

hands (after laying aside the coat, which as is well known shows distinct traces of the cadaveric odor many hours later). Therefore it is no longer necessary to trust blindly in the power for disinfection of calcium chloride in the manner in which it is used since its introduction, and it must (p 491) be enjoined on every student with the utmost conscientiousness not to examine any parturient or gravida, if he has had contact with a cadaver on the same day.

In spite of the greatest caution, puerperal fever cut off 3 to 5% in January and December 1851, and in March 7.2%

In the years 1849 to 1852, as indeed also from the earlier period, all means known up to that time were used with the greatest assiduity, and yet in the school for midwives, where cadaveric infection is not easily possible, the chlorine washings are also most strictly supervised, and the same careful direction and the same well-trained Assistant were functioning and no ascertainable changes in the locale occurred, we had the sad experience of losing from 10 to 12% of the puerperae from childbed fever in January and March 1852 These facts must completely upset the hypothesis of cadaveric infection, which is mostly based upon the past and draws therefrom very audacious conclusions, and warns us to consider other etiologic factors also Of the different influences which could have an effect on the disease-conditions of a lying-in hospital for several decades, can neither the accoucheur instantly give an account, nor can the surgeon give sufficient information on all cases of pyemia and hospital gangrene which appeared during many years among the operated patients, when it is suddenly suggested to him that these diseases are always active, because the surgical pupils are busy with the operative exercises on the cadaver within or without the clinical lecture

To this we have the following to reply. If Carl Braun foists on me the statement in support of my views. "The mortality among the puerperae in the Vienna school, in which physicians who are studying pathologic anatomy, (p 492) are instructed, is constantly much greater than in the school for midwives," then he attributes a falsehood to me The reader knows that the two

obstetrical schools in Vienna were in existence since 1833 (See Table No XXIII, p 139, Table No I, p 3, Table No XXIII, p 140), during the first eight years of its existence up to 1841 medical students and pupil-midwives were assigned to both divisions in equal numbers, the average mortality of these eight years was 6 56% in the First Division, 5 58% in the Second Division, the absolute mortality in the First Division in that eight years was always greater, the relative mortality in the years '34, '36, '38 in the Second Division was greater than in the First Division, the average yearly number of the surplus of the puerperae cared for at the First Division amounted to 1246 With equal possibility of infection there could be no actual difference in the mortality in the two divisions

In the succeeding six years up to 1847, the First Division was exclusively a clinic for physicians and the Second exclusively for midwives before the use of the chlorine washings, and only in these six years was the absolute and relative mortality constantly greater in the clinic for physicians, the average mortality for six years was 9.22% in the clinic for physicians, in the clinic for midwives, 388%, the surplus of puerperae cared for amounted The surplus of mortality of these six years was dependent upon the pathologic-anatomic examinations of the students. the 12 years after the introduction of the chlorine-washings up to 1859, the absolute mortality at the midwives' clinic was greater in 1851 by 46 and in 1852 by 11 deaths than in the same years at the clinic for physicians In 1851 at the clinic for physicians there were 799 more puerperae cared for, 1111 more in 1852 The relative mortality (p 493) during five years at the midwives' clinic was greater than at the clinic for physicians The average number of the surplus of puerperae cared for at the clinic for physicians was 598 yearly

The chlorine-washings have done away with the surplus of

mortality at the clinic for physicians

My statement "The mortaility among the puerperae in the Vienna school in which physicians who were studying pathologic anatomy are instructed, is always much greater than in the school for midwives," applies to the six years, during which the First

Clinic was devoted exclusively to the physicians and the Second exclusively to midwives, before the chlorine-washings were introduced. If C Braun therefore ignores this period and begins with the winter of 1849, when due to the chlorine washings there was no longer any difference in the extent of the mortality in the two divisions, when the extent of the absolute and relative mortality at the First Clinic amounted to 3 57% and at the Second to 3.06%, then C Braun has not invalidated the truth of my statement, he has simply uttered a falsehood

C Braun says that according to Semmelweis the cadaveric particles clinging to the hands have the property of causing puerperal fever during the internal examination of the parturients and he argues against this view of mine for six pages, in spite of this he says, as he comes to discuss the disinfecting properties of calcium chloride, that it does not protect against cadaveric infection, that therefore it must be enjoined with the utmost conscientiousness upon every student not to examine any parturient or gravida, if he has had contact with a cadaver on the same day

Before 1847 the ability of cadaveric particles to cause puerperal fever was unknown to me, in obstetrical examinations therefore I have not been concerned (p 494) whether my hands smelled of the cadaver or not The results which this ignorance has had, I have reported in the proper place in this book. To be convinced is surely safer than ignorance, if therefore C Braun is convinced that the cadaver is not a source of infection, why then does he not once rely on the protective power of calcium chloride, why then does he enjoin his students with utmost conscientiousness not to examine parturients, if on the same day they have had contact with a cadaver?

But to deny something and nevertheless to respect it, is to perpetuate a falsehood

That the cadaver is a source of infection and that calcium chloride disinfects, C Braun himself has proven

We have already had opportunity to relate that during the five-year Assistancy and Professor-ship of C Braun, 24,692 labors took place, out of which there were 613 deaths, or 2 48%, hence the mortality decreased in contrast with the six years of the clinic

for physicians before the chlorine washings, through prevention of the cadaveric infection by means of the chlorine-washings, about 7 44%, and if we take the mortality of the single months, then it rose during the six years before the chlorine washings to 31%, while in the single months during the five-year Assistancy of C Braun the mortality never exceeded 7% For the fifth year and the first year of his professorship, the monthly report is not at my disposal.

We have seen that C Braun attacks the cadaveric infection, and yet seeks protection against it, the same contradiction we find again in connection with calcium chloride, for which he denies any disinfecting properties, and teaches a more thorough method for its use than I taught

In 1848 I made use of the disinfectant property of calcium chloride according to a thorough method, and had ten cases of preventable infection (p. 495) from without C Braun made use of this same disinfectant property according to a more thorough method and had 65 cases in 1849, 37 in 1850, 34 in 1851, 137 in 1852, 52 in 1853, 44 in 1858 of preventable infection from without.

The reason why C Braun had more cases of infection from without in spite of the use of a more thorough method, I find in C. Braun's opposition to my doctrine, whereby the supervision of the students was allowed to fall off

And how competent C Braun is to discuss the etiology of childbed fever is shown by the fact, that he has puerperal fever begin without demonstrable changes and leave off without ascertainable causes, although 30 causes of childbed-fever are known to him. Scanzoni at least lets the puerpera die from puerperal fever only in part from unascertainable causes, for the rest he has a more certain etiologic factor for childbed fever in chance.

As long as I was Assistant, the chlorine-washings were not introduced at the Second Clinic C Braun states that in 1849 the chlorine-washes were also introduced into the Second Clinic and supervised most stringently, how stringent this supervision was is shown by the fact that the mortality, which in the 12 years after the introduction of the chlorine-washings sank from 9 22% to 3 57% in the First Clinic, in the same period at the Second

diminished only from 3 35% to 3.06% The thoroughly experienced Assistant, who supervised the chlorine-washings at the Second Clinic so stringently and notwithstanding had a mortality of 10% in January 1852 and 12% in March 1852 was Dr Spaeth, the present Professor of Obstetrics at the Imperial and Royal Josephs-Academy in Vienna I do not mention Dr Spaeth's name here in order to discredit him thereby in connecting his name (p 496) with a great mortality, but because the reader must believe what I say of the thoroughly experienced Assistant, while he can convince himself of what I relate of Dr Spaeth

Whoever is familiar with the obstetrical literature should know that Dr Spaeth has made preparations which must have contaminated his hand with decomposed matter, as an opponent of my doctrine I doubt his strict supervision and strict personal observation of the chlorine washings, from which comes the possibility of infection, and what we only point out as possible, Chiari tells us has actually happened. After Chiari tells us how puerperal epidemics broke out twice in the Prague Obstetrical Clinic for physicians because the genitals of two parturients became gangrenous, he says. "And also in the clinic for midwives in this place a similar observation was made in the fall, as Dr. Spaeth has told me confidentially" (p 150, line 9)

If C Braun says that at the school for midwives a cadaveric infection is not easily possible, then Dr. Zipfel has long since thoroughly contradicted him

C. Braun says these facts, 1 e the 7% of the First Clinic and the 12% of the Second in spite of the chlorine-washings, must completely upset the hypothesis of cadaveric infection and admonishes him to look around for still other etiologic factors C Braun has looked around and has found 29 etiologic factors Later we shall have occasion to show that the majority of these factors are not etiologic factors for childbed fever at all, and those which are actually etiologic factors for childbed fever, are such only because through them either a decomposed matter is engendered in the individual affected or because through them a decomposed matter is introduced into the patient from without (p 497) These facts have not upset the hypothesis of cadaveric

infection for me, but on the contrary they have strengthened it, because it speaks for the truth of cadaveric infection, if an opponent of cadaveric infection has a greater mortality than the discoverer of cadaveric infection, because his opponent does not oversee the chlorine washings as scrupulously as their originator

oversee the chlorine washings as scrupulously as their originator C Braun reproaches me because I depend on the past, and draw therefrom very bold conclusions I reproach C Braun because he depends mostly on the present and draws therefrom false conclusions

Into what barbarity would humanity sink, if the past were lost for the succeeding generations Can a generation discover navigation and build a great Eastern? How many generations have labored until one contrived a locomotive, which could climb the Semmering?

For all that, we stick to puerperal fever Carl Braun says. "In the winter semester 1849-50 puerperal fever broke out violently as usual in the fall," and from this observation, which is based on the present, he draws the false conclusion that the winter is such that it engenders puerperal fever, the past teaches that in the Vienna Lying-in Hospital during a period of 25 years less than one out of 100 puerperae died, the past teaches that in England during a period of 19 years no puerpera died and during a period of 105 years less than one puerpera out of 100 died in the lying-in hospitals there. I rely on the past and draw therefrom the correct conclusion that winter does not engender puerperal fever (See Table No. XVII, p. 62 and Table No. XXXIV, p. 177)

And if C Braun therefore will not admit the past, because the accoucheur is not in a position (p 498) to account for the influences which could have affected the state of health of a lying-in hospital over several decades, then I have thoroughly refuted this statement of Carl Braun's, because in this book I have frequently had occasion to state what the influences were, on which the state of health in the Vienna Lying-in Hospital was dependent during the 74 years of its existence

C Braun may scarcely remember how much he looked about in the past as he was compiling his textbook of Obstetrics For

of a surety I am convinced that, if we strike out of this textbook everything which is of the past, nothing but the cover will be left which has to do with the present. For even the Greek terminology so helpful in the study of obstetrics and general understanding in obstetrics introduced by C. Braun to ever widening circles is rooted in the past.

My propositions. The mortality among the puerperae in the Vienna school in which physicians who study pathologic anatomy are instructed, in the period represented by Table No I, was always much greater than in the school for midwives

Calcium chloride destroys the decomposed matter and therefore is a protective agent against the puerperal process, this is not upset by the attacks of C Braun

c) The introduction of ichor or exudate from male or female cadavers, which are produced by various kinds of diseases, by means of injection or swabbing on the internal surface of the uterus in rabbits frequently causes death from pyemia after the cast, but a week-long swabbing of the puerperal uterine surfaces many times has no harmful effect, the animals remain healthy, conceive soon after the cessation of the experiment and again cast living young

(p 499) To c) Carl Braun answers: "The experiments on animals have proven that by injections of ichor or swabbing the uterus with different exudate rabbits could frequently be killed after the cast, but many times were not and pyemia was frequently demonstrated at the autopsies on them

In the experiments, which in the manner and the time of execution were very much different from the inculpated cadaveric infection of the parturients, arises the question, whether the mishandling of the animals after the cast could not have produced death and the autopsy results. Because many times the introduction of pus does not produce death, and because experienced veterinarians, such as Hayne and others, acknowledge that among all domestic animals the puerperal process occurs spontaneously many times with greater frequency."

To this we make the following reply "If Carl Braun admits that the autopsy establishes pyemia in the rabbit, then he has

admitted what we wish to show by these experiments, ie that childbed fever is the same disease which occurs in general wherever a decomposed matter is introduced into the circulation.

As for the dissimilarity between these experiments and the cadaveric infection of the parturients, we have already expressed ourselves adequately and at great length in connection with Scanzoni

C. Braun's question, whether the mishandling of the animals after the cast alone would not cause their death and the autopsy findings, we answer with a decisive "No" The animals which did not perish from pyemia were even more extensively mishandled because of the protraction of the experiment The reader will recall that Prof Hayne in the transactions of the Society of Physicians at Vienna claimed for himself priority over my views, but we have not found the confirmation of this in his paper. (p. 500) Prof. Hayne says only that childbed fever occurs less often in animals than in man and finds the reason for this infrequent occurrence in the fact that the animals were not examined as frequently as the patients in the lying-in hospitals, where the disease is quadruplicated through the transfer of the contagium. Hayne also stated that the disease occurred less often in animals, he presumably considers that the disease originates among the animals, as I believe it does in humans, and Carl Braun refers to the same Prof Hayne to prove that the puerperal process also occurs epidemically among animals. Difficile est satyram non scribere (It is difficult not to write a satire)

Likewise the argument, which we derived from the experiments

on animals, has not been upset by Carl Braun

To d) Carl Braun replies as follows: "The history of puerperal fever speaks all too clearly of the spread of puerperal fever epidemics over the various countries, cities, villages in the flat country as well as on the highest mountains, just as present-day experience permits every busy accoucheur to find this fearful disease in the different levels of society, for there to be any doubt on the subject"

The statistical sources on the fatal puerperal processes in private practice are still more difficult to uncover, because the fatal

cases are reported by the physician under other names as. nervous fever, typhus, paralysis of the lungs, etc in the mortality lists published in the newspapers, and because in many countries, as also in Austria it is forbidden by a humane law to list publicly the fatal cases resulting from puerperal and other female disease, such as carcinoma, etc along with the name of their disease."

(p 501) After Carl Braun previously so decidedly found fault with me because I relied on the past, and he himself now refers to the history of puerperal fever, so I am now greatly embarrassed because I do not know whether Carl Braun has been guilty of a contradiction, or whether he is probably of the conviction that the history of childbed fever discusses the future of puerperal fever. Yet we shall leave this doubt unsolved, because we have more important doubts to solve I am in complete agreement with Carl Braun that puerperal fever epidemics are widely spread over different countries, cities, villages of the flat country and of the high mountains, that puerperal fever is discovered in the different circles of society and why not? Carl Braun trains yearly 150 to 200 accoucheurs, and how thoroughly do the students of C Braun understand how to prevent puerperal fever is shown by the 367 preventable cases of infection from without, which occurred in six years This is proved by the 717 preventable cases of infection from without, which occurring during the four-year Assistancy of Gustav Braun, Carl Braun's pupil.

Dr. Spaeth trains yearly at the school for midwives 260 to 300 midwives and how thoroughly Dr. Spaeth's pupil-midwives understand how to prevent puerperal fever is shown by the 12% mortality in the month of March, 1852 Dr. Spaeth to be sure informs his friend, Chiari, confidentially, how puerperal fever is produced, but what one tells a friend in confidence, he does not tell his midwives

Thus are trained infectors for the different countries, cities, villages of the flat countries, for high mountains, for the different circles of society

As for the puerperal epidemics which occur outside of the lying-in hospitals, we have expressed ourselves on them in the proper place in this work (See p 178, line 5 from the bottom).

Likewise the argument which we have used for our opinions (p 502) on the difference between the puerperal fever epidemics within and outside the lying-in hospitals, has not been upset by Carl Braun.

e) The season of the year exerts no influence on the origin of childbed fever

To e) Carl Braun replies the following: "The season of the year and the local conditions resulting therefrom do not exert the most essential, but a still not insignificant influence on the puerperal process. In Vienna the winter semester never shows such favorable results as does the summer semester, and in other places and in foreign lying-in hospitals this same observation is frequently made"

That the seasons of the year have no influence on the origin of childbed fever is proven by Table No II, p 9 and Table No XIX, p. 120. From these tables the reader will perceive that in each month of the year a small, and in each month of the year a large mortality may occur

If Carl Braun says that the winter semester never showed so favorable results as the summer semester, then this is an indication of the amazing thoughtlessness with which Carl Braun writes foolishness; an examination of the monthly reports of the Vienna Lying-in Hospital would show him that of course in the winter months there is more frequently a worse state of health among the puerperae and rarely a better one to be observed, but in the summer months more frequently a better state of health and rarely a worse one But the state of health among the puerperae many times in the winter months was exceptionally favorable and many times was very bad, as Table No XLV, p. 232 show

Why a worse state of health is frequently observed in the winter months and rarely a good one and on the contrary in the summer months, (p 503) thereon the reader will reread p 121

Likewise the argument which we have chosen for the establishment of our view of the seasons of the year, Carl Braun has not upset

f) Puerperal fever rarely occurs in connection with the so-called

street-births.

To 5) "The so-called street-births in Vienna do not become ill from puerperal fever as frequently as those who spend the whole month in the lying-in hospital before the delivery But it must be explained that in this category are included persons who either are actually overtaken by pains on the streets and for the most part deliver prematurely, and for that reason the puerperal process tends to occur much less often among them in the lying-in hospital, or those who are in better circumstances are delivered in a private room by a midwife outside the hospital and are then brought in a carriage or a litter to the free division, in order to obtain free admission and life-long care of their infants in the Imperial and Royal Foundling Hospital along with concealment of their condition and in order thereby at the same time to avoid being used for instruction The number of the latter is the greater, and frequently exceed the number of one hundred monthly at both clinics"

To this we make the following reply. "The reader will recall that we were not permitted to examine the protocols subsequently in order to prove statistically that the street-births become ill strikingly less often than those who were delivered by us Braun, who was Assistant for nearly five years, has had the opportunity to collect these figures, but has not done so and (p 504) is content to say that the street-births became ill no more frequently than those who spent a whole month in the lying-in hospital before delivery, the street-births are most frequently premature deliveries, while all the same the puerperal process tended to occur among them in the lying-in hospital much less often Street-births for the most part deliver prematurely In Vienna the winter semester never shows such favorable results as the summer semester, unless C. Braun understands under premature deliveries the actual street-births, which if they occurred half an hour later, would have taken place in the lying-in hospital"

For street-births, see p 43, line 5 from the bottom and p 69, line 12 from the bottom

For premature deliveries, see p 46, line 18 and p 70, line 3. Again the argument which we have taken from the street-births for the establishment of our doctrine, has not been upset by Carl Braun

g) Presumably there occur in all obstetrical departments, in which midwives are trained and where cadaveric infection is not easily possible, fewer fatal cases than in those in which physicians are trained.

To g) Carl Braun replies: "Likewise the question, whether the largest lying-in hospital in the world, in which 223,868 puerperae along with their infants have enjoyed up to now an entirely free care by the State, has suffered a wholly exceptional mortality, we must answer in the negative.

At the Vienna Free Division, which was never closed on account of puerperal fever epidemics, as has frequently happened for months at a time in all the foreign institutions named, the mortality percentage on the average was 33% (at the school for physicians 5.9%, at the school for midwives 32), in Paris at the Maternité, where no students are admitted, 4.1%, in Dubois' clinic 56%, (p. 505) in Hospital Beaujou, where no instruction is given, 16% The British lying-in hospitals show a lesser, the German a similar, the Scandinavian a higher mortality percentage, and indeed without distinction as to whether physicians or midwives are instructed, as we have attempted to show in our statistics

If one considers further, that the Vienna Clinic for physicians presents not merely the fatal puerperal processes, but also the acute diseases, such as eclampsia, pneumonia, meningitis, apoplexy, etc, which are important subjects for study, that without exception all new-arrivals, even the sick gravidae discharged from the General Hospital must be admitted, that the number of admission-days are 52-70 more yearly than at the school for midwives, while all complicated labor cases from the capital city and the surrounding districts and from the poorest classes of the people are admitted to the Free Division, that transfers of puerperal fever cases did not occur as a rule, that during the winter semester, the epidemic season, the First Obstetrical Clinic must often admit about 100-200 labor cases more each month than the Second Clinic, while in summer, when there is a better state of health for both clinics alike, the clinic for physicians now and then shows even a lesser number of deliveries in the monthly reports than the

school for midwives, as is seen in Table No XVII, that complicated labors because of their value for instruction are taken to the First Obstetrical Clinic as much as possible, that no spontaneous ventilation ensues from opening the doors because of the architectural lay-out in the clinic for physicians, that this division up to 1845 was situated much closer to the sick-wards of the General Hospital, which cared for over 20,000 patients yearly, then a difference in the mortality lists several percent higher at the school for physicians may thus be explained in an entirely natural manner, without being forced to take refuge in the hypothesis of cadaveric infection, lacking in direct proof and based upon conjecture.

We cannot therefore endorse a thesis, advanced for the proof of the hypothesis of cadaveric infection based on the observations made in the Vienna Lying-in Hospital, in every particular, we certainly cannot blame contact with the cadaver as an outstanding cause of puerperal fever epidemics in lying-in hospitals, but we shall consider it the greatest presumptuousness to allow or even to undertake an examination or an operation on a gravida, parturient or puerpera with hands which even after the most assiduous scrubbing allow perception of the cadaveric odor. To this we have the following to reply "In order to read out

To this we have the following to reply "In order to read out of our proposition "Presumably there occur in all obstetrical departments in which midwives are instructed and where cadaveric infection is not easily possible, fewer fatal cases than in those in which physicians are trained" The question is, does the largest obstetrical hospital in the world suffer from an entirely exceptional mortality? That requires a sagacity as seems to be peculiar to Carl Braun only—If Carl Braun wishes to defend the statement that the Vienna Lying-in Hospital suffers from no entirely exceptional mortality, then he has in me a companion-in-arms, we ourselves have angrily rejected even the Virchow-Veit impeachment of a frightful mortality, the mortality in the Vienna Lying-in Hospitals, in which similar conditions prevail—If in such lying-in hospitals as these, fewer puerperae die than in the Vienna Lying-in Hospital, then the reason is that such lying-in hospitals are fre-

quently closed for months at a time because of the greater mortality, which is not done in Vienna, and that every puerpera, as soon as she is suspected, is transferred to a general hospital, (p 507) while such transfers occur only in exception-cases in Vienna

But if Carl Braun cites circumstances to explain the surplus mortality at the clinic for physicians in contrast with the clinic, without being forced to take refuge in the hypothesis of cadaveric infection lacking in direct proof and based upon conjecture, then he finds in us a most resolute opponent. The reader knows that the two Vienna obstetrical clinics since 1833, i.e. up to 1859 were alongside one another, that in the first eight years of their existence up to 1841 the excess of the relative mortality varied between the two divisions, and that the average mortalities of the two divisions were almost identical. In the succeeding six years up to 1847, the absolute and the relative mortalities in the First Clinic were constantly greater and the average mortality in the First Clinic was more than three times as great as in the Second.

In the last 12 years from 1847 to 1859, the excess of the absolute and the relative mortality varied between the two clinics and the average mortalities in the two clinics were almost identical

Carl Braun's period of service, during which he got to know the unfavorable conditions in the First Clinic and to which, and not to the cadaveric infection, he ascribes the preponderance of mortality in the First Clinic, extended over the years 1849, 1850, 1851, 1852 and 1853, accordingly in a time, when the absolute and the relative mortalities varied between the two divisions, and when the average mortalities in the two divisions were almost the same if therefore, these unfavorable conditions during the five-year service of Carl Braun could not only produce no constantly greater mortality at the First Clinic, if even in spite of these unfavorable conditions the absolute mortality could be greater at the Second Clinic in 1851 with 46, in 1852 with 11 deaths (p 508) than at the First Clinics, then it is proven with mathematical certainty, that these unfavorable conditions have not also caused the three-fold mortality of the six years, 1 e from 1841 to 1847

We could therefore save ourselves the trouble of going into a

refutation of these unfavorable conditions; but we would therefore miss the opportunity to point out to the reader the terrible thoughtlessness with which Carl Braun proceeded in his opposition to my doctrine

Carl Braun says "The Clinic for physicians presents lethal puerperal processes, eclampsia, pneumonia, meningitis, apoplexy, etc, the Second also presents these same diseases"

That without exception all new-arrivals, also the sick gravidae discharged from the general hospital, must be accepted in the First Clinic. If there is an admission-day, all new-arrivals and also the sick gravidae from the hospital must likewise be admitted without exception to the Second Clinic That the number of admission-days is about 52–70 higher yearly at the First Clinic than at the Second

By law the First Clinic every week has one more admission-day, therefore 52 admission-days more yearly, I ask, which clinic was more over-crowded, the Second, which, although it has 52 admission-days less, nevertheless could not take over the admission eighteen times, or the First, which, in spite of the 52 admission days more yearly, could take over the admission eighteen times when the Second was overcrowded?

Were all the complicated labor cases from the capital city and surrounding districts admitted to the Free Division? This postulates then at least no difference in the mortality of the two divisions. As a vindication of two free divisions as teaching institutions, I advise the reader that during my five-year stay at the First Clinic only one (p 509) complicated labor case, i.e. a neglected transverse presentation, was assigned to it

As a rule in both divisions, transfers of puerperal fever patients do not occur

That in the winter semester, the epidemic season, the First Obstetrical Clinic must frequently have admitted from 100 to 200 more labor cases than in the Second Clinic, while in the summer, the period of a better state of health in both clinics alike, must indeed have presented at times even still smaller numbers of labor cases in the monthly reports than the school for midwives, is to be learned from Table No XVII.

Table No XVII, to which Carl Braun refers in order to prove

by figures that in the winter semester, the epidemic season, the First Clinic must frequently admit 100 to 200 more labor cases monthly than the Second, while in summer, the time of the better state of health for both clinics alike, the clinic for physicians presents indeed at times even still smaller numbers of labor cases in the monthly reports than the school for midwives, contains the monthly reports of both clinics from the years 1849, 1850, 1851 and 1852, i.e. 48 months.

Of these 48 months, there were 43 in which the number of puerperae cared for was greater at the First Clinic and five in which the number was greater at the Second. During the 43 months, in which more puerperae were cared for in the First Clinic, the absolute mortality in 26 was smaller than in the Second, in which a smaller number of puerperae were cared for.

(p. 510)

Clinic for Physicians

(p. 510) Clinic for Physicians							
		Births	Deaths	Mortality %			
June	1852	403	3	0 6			
January	1852	417	25	5 9			
October	1852	391	9	2 3			
May	1851	415	4	0.8			
March	1852	412	30	7 2			
April	1852	394	11	2 7			
February	1849	389	12	3 8			
February	1852	367	16	4 3			
January	1851	366	13	3 5			
June	1851	353	2	05			
December	1850	343	5	14			
March	1851	388	2	0 5			
December	1851	371	19	50			
January	1849	403	9	2 2			
February	1851	353	2	05			
September	1851	315	5 8	15			
Aprıl	1849	353	1	2 2			
November	1851	301	5 3 6	1 6			
July	1851	327	3	0 9			
December	1852	33 ¹	i	1 8			
July	1850	282	I	0 3			
May	1849	387	6	15			
October	1850	306	4	1 3			
October	1851	291	4	1 3			
October	1849	265	2	0 7			
September	1850	287	I	0 3			

Clinic for Midwives

		Births	Deaths	Mortality %	Burths Less	Deaths More
June	1852	249	12	4 8	154	9
January	1852	279	35	12 5	138	10
October	1852	257	13	4 4	134	3
May	1851	305	6	19	110	2
March	1852	304	31	10 1	108	r
April	1852	288	14	48	106	3
February	1849	296	14	47	93	2
February	1852	284	22	77	83	6
January	1851	290	17	58	76	4
June	1851	277	6	2 1	76	4
December	1850	269	16	58	74	11
March	1851	314	3	09	74	1
December	1851	306	27	8 8	65	8
January	1849	342	18	52	61	9
February	1851	291	9	30	61	7
September	1851	257	12	46	58	7
April	1849	295	12	40	58	4
November	1851	244	13	53	57	8
July	1851	272	6	2 2	55	3
December	1852	283	25	53	48	19
July	1850	241	2	0.8	41	1
May	1849	341	8	23	40	2
October	1850	267	7	26	39	3
October	1851	256	12	46	35	3 8
October	1849	234	4	17	31	2
September	1850	265	3	11	22	2

(p. 511) In these 26 months, all the months are represented with the exception of August, January appears three times, February three times, March twice, April twice, May twice, June twice, July twice, September twice, October four times, November once, December three times

In these 43 months, the relative mortality in 29 was less than at the First Clinic.

		First			Second				
		Births	Deaths	%	Births	Deaths	%	Births Less	Less Rel Mort
April May Sept.	1851 1852 1849	38 <i>9</i> 388 281	7 18 2	1 5 5 0 0 7	302 323 248	6 18 2	1 9 5 5 0 8	87 65 33	0 4 0 5 0 1

In these 29 months, all the months are represented with the exception of August, January three times, February three times, March twice, April three times, May three times, June twice, September three times, October four times, November once, December three times.

These two tables show us 16 months of the winter semester, the epidemic season, in which with 138 more puerperae cared for

(p 512)

Clinic for Physicians

		Births	Deaths	Percent
March	1846	406	20	4 9
July	1852	357	16	4 4
Jan	1850	356	14	3 9
Sept	1852	362	11	30
Feb	1850	346	15	4 3
March	1850	340	17	50
Nov	1850	329	9	2 8
Aprıl	1850	319	3	09
Dec	1849	291	13	4 4
Aug	1851	325	9	2 7
Aug	1852	321	22	67
Nov	1849	290	, 16	5 5
June	1850	269	2	07
July	1849	271	3	11

Clinic for Midwives

		Births	Deaths	Percent	Births Less	Deaths More
March July Jan Sept Feb March Nov April Dec Aug Aug Nov	1849 1852 1850 1852 1850 1850 1850 1850 1849 1851 1852 1849	311 263 275 283 272 280 282 272 245 287 282 254	13 11 3 4 7 8 4 1 2 4 5 3	4 I 4 I 1 O 1 4 2 5 2 8 I 4 O 3 O 8 I O I 7 I I		
June July	1850 1849	146 269	1	0 4	2	2

in the First Clinic the mortality was smaller than in the Second These tables show us at the same time 13 summer months when there is a better state of health, in which 154 less puerperae were cared for in the Second Clinic with a greater mortality

Only in 14 months at the First Clinic was there a greater mor-

tality among a greater number of puerperae cared for

(p 513) With the exception of May and October, January appears once, February once, March twice, April once, June once, July twice, August twice, September once, November twice, December once

This table points out to us the seven months of the winter semester (the epidemic), in which a greater mortality prevailed at the First Clinic along with 95 more puerperae cared for than at the Second

I permit myself to ask with what right one can ascribe the greater mortality at the First Clinic, during the seven months of the winter semester, the epidemic season, to the preponderance of 95 puerperae cared for, if in the 16 months of the winter semester, the epidemic season, the mortality at the First Clinic with an excess of 138 puerperae cared for is smaller than at the Second?

At the same time, these tables point out to us seven summer months, the season of a better state of health, in which neither as many nor more, but even 94 less puerperae were cared for in the Second Clinic.

In five months the number of puerperae cared for at the Second Clinic was greater than at the First Clinic

But alas! the First Clinic with less deliveries in the summer, the season of a better state of health, (p 514) twice had a greater mortality than the Second and twice an equal mortality, and once more, alas! there is in these five months a month of the winter semester, the epidemic season, when the First Clinic had one death more among the 37 lesser parturients cared for than in the Second

"That complicated labor cases were and are brought to the clinic for physicians for teaching purposes as far as possible" Such was not the case during the five years during which I was at the First Clinic and if it was the case under Braun, yet this

does not postulate a greater mortality at the First Clinic, because the mortality at the Second Clinic was greater in 1851 with 46 deaths and in 1852 with 11 deaths

"That no spontaneous ventilation took place at the clinic for physicians on opening the doors on account of the architectural lay-out of the building. That this division up to 1849 lay much closer to the sick-wards of the general hospital, which cared for over 20,000 patients yearly"

In 1848, 45 puerperae died at the First Clinic due to the presence of these drawbacks

The reader has seen that none of these drawbacks urged by C. Braun is plausible, and yet he says. "That a difference in the mortality lists several percent higher at the school for physicians may thus be explained in an entirely natural manner, without being forced to take refuge in the hypothesis of cadaveric infection, lacking in direct proof and based upon conjecture"

Likewise the reader has seen that the argument for my opinion on the origin of childbed fever was not upset in the least by C. Braun's attack, and nevertheless he says. "We cannot therefore endorse a thesis advanced for the proof of the hypothesis of cadaveric infection, based on the observations made in the Vienna Lying-in Hospital, in every particular, (p 515) we certainly cannot blame contact with the cadaver as an outstanding cause of puerperal fever epidemics in lying-in hospitals, but we shall consider it the greatest presumptuousness to allow or even to undertake an examination or an operation on a gravida, parturient or puerperae with hands which allow perception of the cadaveric odor even after the most assiduous scrubbing"

What monstrous hypocrisy!!!

Why has it not been said and written before 1847? "That it would be the greatest presumptuousness to allow or even to undertake an examination or an operation on a gravida, parturient or puerpera with hands which allow perception of the cadaveric odor even after the most assiduous scrubbing."

We return to g) once more As to how we established our thesis "Presumably there occur in all obstetrical departments, in which midwives are trained, and where cadaveric infection is

not easily possible, fewer fatal cases than in those in which physicians are trained," the reader should reread p 123, beginning at line 3

We shall see what Carl Braun has to object to our thesis in the statistical part of his treatise

In order to show that the mortality is just as large in the school for midwives as in the school for physicians, he cites the Maternité in Paris in which midwives only are trained and where a cadaveric infection through physicians and midwives cannot occur, and Dubois' clinic where the students are engaged in operative exercises during the course, and near which the autopsy-room is located also, and nevertheless an equivalently large mortality prevails in both institutions

We have shown that the pupil-midwives at the Maternité contaminate their hands with decomposed matter (p 516) to the same extent as do the students at Dubois' clinic and hence the equivalently large moitality

In order to show that lying-in hospitals which are not teaching institutions, also have a large mortality, Carl Braun cites the Hospital Beaujou in Paris, in which 16% of the puerperae died, even though it is not a teaching institution. But here also all who are overtaken by labor are accepted

The reader knows that the St Rochus Lying-in Hospital is not a teaching hospital, and nevertheless it had a large mortality, because the Accoucheur-in-Chief was at the same time Surgical Chief and Coroner's physician.

Because I could not find more exact information in the literature on conditions at this institution, I wrote to Prof Dietl at Cracow about it and received the following answer "To my knowledge, Beaujou has absolutely no obstetrical department. By virtue of a humane regulation, it was the custom there to accept only sick nursing mothers with their nurslings, if they would take them along with them into the hospital, in order thereby to prevent the possible exclusion of such patients They occupy separate small wards of four to six beds and are entirely isolated from other patients so that the children may not disturb them

So far as I can recall, there is a physician in the department to which this small division of sick mothers is assigned."

Although Carl Braun enumerates 30 causes for childbed fever, he has however forgotten the thirty-first, for he does not mention in his etiology that the sudden onset of a precipitate labor can also be an etiologic factor for childbed fever We believe indeed in recalling the street-births at Vienna, the sudden onset of a precipitate labor offered protection against puerperal fever (p. 517) Carl Braun finds the reason for the more favorable state of health in the English lying-in hospitals in contrast with the French and German lying-in hospitals in the fact, that in English lying-in hospitals only married women are admitted, while in French and German lying-in hospitals the unmarried only are delivered. We have established at great length the reason for the more favorable state of health in the English lying-in hospitals, for the present we do not believe that our prophylaxis against childbed fever is so deficient that we should recommend matrimony as a protective measure against puerperal fever

If Carl Braun cites the Scandinavian lying-in hospitals in order to show that, in spite of the most extensive use of chlorine, puerperal fever epidemics nevertheless can break out, still this does not prove anything against my doctrine, but proves only that there will be no salvation for lying-in hospitals, just as long as the intolerance of a single student can stultify the most admirable

regulations We point again to the law proposed by us

Of v Siebold's clinic in Gottingen, it was said that in three years (1850-1852) there were 349 patients delivered of whom 6 died, 1 e. 1 6%. As is well known, a large number of students are instructed here The 349 labors were spread over three years, on every third day a labor took place, it probably happened in Gottingen that the great majority of students had no contact with cadavers on the very days when there was a delivery, and vice versa Kiwisch had indeed lost 27 out of 102 puerperae from childbed fever, his clinic was connected with a gynecological department, six deaths out of 349 puerperae gives at least four preventable cases of infection from without

Of the Vienna Lying-in Hospital, Carl Braun gives the following description "The lying-in hospital is a part of the great general hospital, comprises three divisions, the clinic (p 518) for physicians, the school for midwives and the department for private patients

The division for the training of physicians up to 1850 occupied eight wards in the first and second stories with a capacity of about 200 beds, which were so situated that three wards of the general hospital, which were occupied by patients suffering from typhus and other internal diseases, were located over the lying-in wards and in three other places the sick wards were separated from the other lying-in wards merely by a door

Every puerpera three hours after a normal delivery has to walk a distance of 50 to 100 paces through one or more lying-in wards to the bed assigned to her, and on this journey she has to traverse a glass-enclosed passage-way leading to the main stair-case, which indeed is heated in the winter-time, but never reaches the normal temperature of the lying-in wards. The wards are arranged one after another in a row (separated only by a small kitchen or two small rooms) without any corridor, hence a fortuitous ventilation can not occur.

The wards are roomy, the beds are the same distance apart as in the other clinics. Heat is supplied by the Meissner Jacket-furnace, by which the cold air entering between the stove and the Jacket is warmed and enters the ward a fathom above the floor, while the air of the room is obliged to pass through an opening, a square foot in area, at the side of the stove near the floor

This ventilation is not available in summer and is inadequate in winter, because the puerperal odor cannot be removed during several hours of heating and ventilation. For this reason several windows, which reach to within six or seven feet of the floor, must always be opened

(p 519) the beds stand under the windows The smooth floor is not oiled The walls are painted white every year The upper and under woolen blankets are changed frequently every eight to four days, the bed-linen daily The privies are open, guarded by iron gratings to prevent infanticide and may not be used by the puerperae, who must be served with bedpans by the nurses

The laundry up to 1852 was leased to a contractor, who con-

tinually mixed up the bed-linen of the lying-in hospital and the general hospital Now each establishment has its own contractor Because of overcrowding, most of the puerperae must be shifted on the seventh or eighth day for the second time, when they walk or are transported to the second floor up a staircase partly enclosed by glass Every healthy puerpera must be discharged on the ninth day because of the continual congestion of new arrivals Every eight days, therefore, all puerperae are removed from a ward, the floor is scrubbed, the worn, dirty strawmattresses and woolen blankets as well as the linen are changed and the renovated lying-in ward is aired for as many hours or days as the number of newly-admitted will allow For several years there have been two heated rooms for the repeated drying and warming of the blankets and sheets, because the contractor of the laundry could not fulfill this necessary requirement due to the extravagance. In 1850 another arrangement of the lying-in wards was made, at present therefore there are five wards on the first floor and four on the second Thus the patients of the general hospital who are over the lying-in ward, are removed and the disadvantages of the two shiftings of patients are thereby avoided to some extent, because the puerperae (p 520) are transported by two stretcher-bearers in a well protected litter from the delivery-room to the second floor and in part also to a ward on the first floor, where they can remain up to the day of discharge The puerperal fever patients are isolated from the healthy patients and lodged in a ward set aside for them and closely connected with the department The partitionts are admitted four days a week and in the Second Clinic two days a week The clinical instruction and the visits take place in the lying-in wards in the morning from eight to eleven and the candidates are allowed to examine the patients outside of these hours only in the presence of the Professor or the Assistant The two candidates who keep the journal and examine all the newlyadmitted patients are changed every day Ten certified midwives are assigned to oversee the conduct of the normal labors in the labor-room

According to the custom up to the present time, puerperal

fever patients are not transferred to the general hospital as a rule. An accurate account of the transfers of patients with syphilis and smallpox is not possible, because all healthy and diseased patients departing are included under a common rubric "Discharged" in the early years and only in the last three years was the reason for the transfers made known to the administration in the daily report. During the last five years, there were not over 15 cases of puerperal fever on the average, who, because of extensive decubitus, were dangerous to the healthy puerperae and transferred to the general hospital

During the noon-hour the numerous students are instructed in the obstetrical operations with female and infant cadavers, while at the same time the midwives practiced vaginal examinations on the phantom and fetal cadaver outside the obstetrical department

When one considers that at the obstetrical clinic for physicians (p. 521) the daily rate of admissions for gravidae varies from 50 to 120, that 30 beds are set aside for the labor- and sick-wards, that with the highest daily rate all the gravidae of this school must be lodged in 50 beds, and that consequently over 400 puerperae must be cared for over a period of eight days with 120 beds, the degree of overcrowding is thus demonstrated and above all the consequences resulting therefrom.

The clinic for the instruction of midwives has an arrangement analogous to the foregoing, but is built according to the cubicle system and there runs next to the lying-in ward a long corridor, from which the remaining intercommunicating lying-in wards can be entered. Over the doors are constructed some broad windows a foot square in size, so that through these, as well as through the frequently opened doors, a casual ventilation by means of the corridors may be produced in a practical manner. The puerperae can reach the lying-in wards more easily without having to travel over a chilly passage-way the greater part of the time. The clinic does not immediately adjoin the divisions of the general hospital and is surrounded for the most part by a garden-court in which are the rooms of the chief physicians and officials.

The number of beds in this clinic is approximately 20 to 30 less than in the First Clinic and it has moreover approximately six to eleven hundred fewer puerperae to care for yearly. One must not also overlook the fact that this clinic has about 52 fewer admission-days per year, therefore four times weekly has more time to clean the wards allotted to the reception of the newly-admitted patients than is possible in the First Clinic on account of the excessive overcrowding. The placentas from both clinics are daily removed from the house. The nurslings are left beside the beds of the mothers day and night. (p. 522) The two obstetrical schools are never closed to parturients on account of puerperal fever epidemics, as least as far as we could learn. Since the foundation of these lying-in hospitals, teaching has been carried on without interruption even during the holidays. In the last decade, there were trained yearly from 150 to 200 accoucheurs and from 260 to 300 midwives.

With this description of the two clinics, Carl Braun wishes to acquaint the reader with some of the disadvantages of the First Clinic, by which at the school for physicians a somewhat higher percentage in the mortality lists may be explained without having to resort to the hypothesis of cadaveric infection, lacking direct proof and based on conjecture.

We have already stated once that Carl Braun became familiar with the unfavorable conditions in the First Clinic at a time, when these unfavorable conditions could not only make no difference in the size of the mortality in both divisions, in which period the mortality at the Second Clinic was many times greater than in the First in spite of the unfavorable conditions there. Thus in 1851 at the Second Clinic, out of 799 puerperae cared for, 46 died, in 1852, out of IIII less puerperae cared for, II more puerperae died than at the First Clinic

It is thus proven with mathematical certainty that these unfavorable conditions in the First Clinic did not cause the greater mortality at the time when a greater mortality actually prevailed in the Second

We feel that we are excused from the duty of showing how Carl Braun partly misrepresents these drawbacks in order to make

them appear still more unfavorable at the First Clinic and more favorable at the Second Clinic than they are in reality, we take exception to two points only

The First Clinic in my time had eight wards, (p 523) now it has nine, the Second has one or two less wards, because of the fewer admission days per week. At the First Clinic there were cared for 4,000 puerperae yearly, and six to eleven hundred less per year in the Second, according to Braun

The reader sees what conception Carl Braun has of the cubicle system, if he has the Second Clinic built according to the cubicle system, which, we say, cared for 2900 puerperae yearly in nine wards

We have seen previously that the table to which Carl Braun refers, in order to strengthen his assertion numerically, "that in the winter semester, the epidemic season, the First Clinic must accept from 100 to 200 more labor cases monthly, than does the Second Clinic, while in the summer, the time of the better state of health for both clinics, the clinic for physicians shows at times a still smaller number of labor cases in the monthly report than at the school for midwives", this assertion of his is completely confirmed

Likewise we find confirmed that which Carl Braun says of the prevalent overcrowding at the First Clinic and above all the results issuing therefrom, while at the Second 600 to 1100 less puerperae were cared for, if we examine the yearly report of both clinics.

During the first eight years the average mortality was almost the same, the surplus of puerperae cared for yearly amounted to 1246 at the First Clinic

In 1834 with 913 less puerperae cared for, the relative mortality at the Second Clinic was about 0 89% greater

In 1836 with 1,007 less puerperae cared for, the relative mortality at the Second Clinic was about 3 37% greater

In 1838 with 1208 less puerperae cared for, the relative mortality at the Second Clinic was about 1 90% greater than at the First (See Table No XXII, p 139)

(p 524) In the six years in which the mortality of the First

Clinic was three times as great as at the Second, the surplus of puerperae cared for at the First Clinic yearly was only 375 (See Table No. I, p. 3)

In the 12 subsequent years, the average mortality at both clinics was almost the same, the surplus of the puerperae cared for amounted to 598 The absolute mortality for two years and the relative mortality for five years with 1111 less puerperae cared for in the Second Clinic was greater at the Second Clinic than at the First (See Table No. XXIII, p. 140)

Carl Braun says: "Since the announcement of the theory of cadaveric infection, over five years have gone by; so we shall quote the opinions, loudly voiced in the literature on this subject up to this time, of some physicians who are familiar with the conditions in the lying-in hospitals." He quotes now the opinions of Scanzoni, whom he names as a particularly severe opponent of this theory, Seyfert, Kiwisch, Lumpe, Mande, Bamberger, Hammernjk, the Academy of Medicine in Paris, Retzius, Faye, Chian and says finally: "Nowhere in the literature do we find any acknowledgement of the credibility of the infection-theory in its practical application. We even found the most decided statements and principles derived from experience as quoted, which deprive this hypothesis of its most important foundation.

If Carl Braun asserts that even after more than five years the literature still shows no acknowledgement of the credibility of the infection in its practical application, then the attentive reader of this treatise should know this is not so. But we admit that it is actually true that after five years my views on the origin of childbed fever have never been verified in practice, but that is no proof that my views are wrong, but it is a proof of the incompetency of all those who had the opportunity to confirm my views (p. 525) in their practical application and yet did not do so.

That my views were confirmed in their practical application during my period of service in Vienna, is an eternally true fact, if my views are wrong, they could not have been established in their practical application during my period of service

What is true in Vienna, is true for the whole world, and if the truth, which could be established in Vienna, cannot be established

elsewhere, then the truth does not thereby become a falsehood, but anyone who could not establish the truth has proven his own incompetency

In the time of need, one learns to know his friends, and in the necessity in which I have found myself, because my views have not been confirmed in their practical application, I find a true friend in Carl Braun, because Carl Braun, after me, has lowered the 992% mortality to 248% He has therefore, in confirmation of my views in their practical application, decreased the mortality of the First Clinic about 744%.

Naturally it is only modesty that keeps Carl Braun from acknowledging his meritorious conduct to the world, but the timid virtue, if it hides in obscurity, will find a devoted admirer to bring it out into the daylight

From still another quarter, whence I least expected it, there has come a friend, Scanzoni, the austere adversary of this theory as Carl Braun calls him, who has revealed himself as a secret adherent. As confirmation of the infection-theory in its practical application during six years in Wurzburg, Scanzoni has lost only 20 out of 1639 puerperae from childbed fever. (p. 526) With Scanzoni, it is again only modesty which has hidden this meritorious conduct of his in Silberschmidt's paper.

If Carl Braun, Scanzoni and Semmelweis fight for the truth, then triumph is certain, and liberated mankind cannot deny the palm of victory to the allies

As for the opinions which Carl Braun quotes from the literature, we have reviewed those of Scanzoni, Seyfert, Kiwisch, Lumpe, Bamberger, Hammernjk, and the Academy of Medicine at Paris

Mende doubts the correctness of the theory of cadaveric infection and believes the cause of the frequency of puerperal fever in Vienna must be sought in the unsatisfactory ventilation, the accumulation of many puerperae in closely crowded quarters in the general hospital and the production of miasmata favored thereby But Carl Braun knows as well as I, that these conditions were not changed and yet the mortality was significantly decreased and indeed by Braun himself through his fight against

cadaveric infection; why then should there be quoted an opinion, when Carl Braun must himself be convinced of its falsity?

Ritgen of Stockholm lost 3.3%, Faye of Christiana 15% of

the puerperae in spite of the chlorine-washings.

We have already said that the Scandinavian lying-in hospitals prove that, in spite of the excellent accommodations, no improvement may be expected in the situation there until the law proposed by me is put into operation to its fullest extent.

If Carl Braun says that such an enormous mortality, as Faye has had, was observed only once, before the chlorine-washings, in 1842 in the twenty times larger Vienna clinic for physicians, so we perceive therefrom, that he probably means to decry the mortality due to puerperal fever as a corroboration of the credibility of cadaveric infection in its practical application, (p 527) but that he does not place complete faith in all the circumstances of childbed fever, for otherwise, Carl Braun should know that in an institution twenty times as large, many hundreds and hundreds of patients are certainty not used for teaching, which in that case makes the enormous mortality of those used for teaching appear less enormous.

But in an institution where 150 to 200 labors take place, every case will be used for teaching and in spite of the excellent regulations should only one indolent individual be present, there will

be an enormous mortality

To my most painful surprise, I find Chiari ranked among my adversaries, but Chiari has contradicted the aspersion, the reader will recall that Chiari, after he became familiar with my views on the origin of childbed fever, did not explain the death of patients with fibrous uterine polypi by epidemic influences, but

by infection

The reader will recall that in the Society for Physicians, Chiari at Vienna declared that the mortality at the First Clinic is dependent on conditions, which would be more exactly defined by Dr Semmelweis, and Chiari, when he suffered the indignity of being placed among my adversaries (See 148), already had the paper in his desk, in which he reported that a puerperal fever epidemic had twice broken out in Prague, and that an ichorous discharge issued from the genitals of two parturients

So that the reader may be convinced that Chiari intended no opposition to me in the treatise to which Carl Braun refers, in order to characterize Chiari as an adversary of mine, we shall reproduce this paper here word for word:

(p 528) PROTOCOL OF THE MEETING OF THE SECTION ON PHYSIOLOGY AND PATHOLOGY FOR JUNE 27, 1851*

Docent and Acting Chief-Physician Dr. Chiari read a paper on "Pyemia in Puerperio in the Absence of Uterine Disease."

There not infrequently occurs among puerperae cases of illness with the so-called typhus-manifestations, in which, because of the absence of demonstrable uterine pathology, the diagnosis of typhus is very frequently made. The course of this disease condition is usually as follows:

After an apparently trifling indisposition in the first week of the puerperium, a very high fever sets in along with severe chills and the abdomen as well as the uterus shows no tenderness, the lochial discharge does not vary from the normal, the spleen enlarges, in the lungs are often found signs of a significant catarrh, the urine sometimes contains pus, the temperature of the skin is considerable and the skin itself is dry, delirium is usually present. Along with these symptoms after a six to eight day duration of the disease, there comes a quick decline in strength along with an early death as a rule

In occasional cases, rigors and a yellow discoloration of the skin appear even in the last days

At the autopsy are found metastatic inflammatory foci in the different organs, with no evidence of phlebitis or endometritis in the uterus as a starting point for the infection.

It may now be asked, how are the origin of the metastatic inflammatory foci to be explained?

(p 529) In individual cases, one must indeed assume that an inflammation of the uterine veins or the internal uterine surface has preceded and already subsided as shown by the persistent thickening of the coats of the larger uterine veins, just as in those

^{*}Zeitschrift der k k. Gesellschaft der Aerzte zu Wien Year 7 December, 1851 P CLXI

cases where after an unmistakable metrophlebitis healing is achieved. On the other hand, for the other cases, in which no trace of a uterine affection may be found, must one raise the question, whether here the blood-mass tends to a purulent decomposition "

Where is the attack on my doctrine hidden in this paper?

My doctrine says: the first requisite in the engendering of child-bed fever is the absorption of a decomposed matter, the second is the disintegration of the blood, and in this stage the disease can indeed be fatal, and with these two things the nature of childbed fever is stated. Exudates and metastases can be present and can also be lacking. With the occurrence of metastases local inflammatory foci can usually be demonstrated as the sources of the metastases. If metastases are present without demonstrable foci of inflammation, this fact does not speak against my doctrine. We shall not go into an explanation of these contingencies in this treatise, which is dedicated to teaching the origin, the prevention and the concept of childbed fever.

Since we have successfully defended, as we believe, decomposed matter as the only cause of childbed fever against the attacks of Carl Braun, we shall pass over to the criticism of the thirty causes of childbed fever, as enumerated by Carl Braun. It will be shown that many of these causes are actually causes of childbed fever (p. 530) only in so far as either a decomposed matter is thereby engendered in the affected individual, or because it has thereby been introduced into the individual from without, and consequently the Braun etiology is in error, where it teaches something other than what I do, and becomes truth when it teaches what I teach.

To the etiologic factors of childbed fever, as enumerated by Carl Braun, though not etiologic in fact, belong. I. conception and pregnancy, 2 hyperinosis, 3 hydremia, 4 uremia, 5 a general plethora of the gravida, 6. a disproportion in the vegetation of the mother and the fetus, 7 the vascular engorgement and stasis of blood resulting from pregnancy, 8 whether inopexy can contribute to the production of the puerperal process remains for decision by further observation, 9 pregnancy fever is no cause of puerperal fever, but a true, genuine puerperal fever occurring

during pregnancy, II the equalization of hyperinosis, I2 the inopexy of the puerperium, this does not exist in the physiological state, in the pathological state it is a result of the puerperal fever already present and not a cause

13. The increased pressure upon the neighboring organs caused

by the decrease in size of the uterus

15. Injury to the internal surface of the uterus by the separation of the placenta

16 Puerperal thromboses and metrorrhagia Puerperal thromboses do not exist in the physiologic state, as we have shown, in the pathologic state they are not the cause but the result of childbed fever already present Metrorrhagia is not a cause of childbed fever. (p 531) Before the introduction of the chlorine-washings, with the exception of a few cases, puerperal fever always occurred in the First Clinic in Vienna as a result of metrorrhagia, since the introduction of the chlorine-washings, puerperal fever after metrorrhagia was very rarely observed.

Before the introduction of the chlorine washings, the internal examinations, which were necessary because of hemorrhage, were done with unclean hands for the removal of the placenta, of blood-clots, etc., after the introduction of the chlorine-washings with clean hands, consequently, metrorrhagias were not the cause of puerperal fever, but merely the occasion for the introduction of decomposed matter by means of the examining fingers or the

operating hand

18. Suppression of the milk secretion

20. Individuality of the puerperae

22 Emotional upsets

23 Errors in diet 26 Chilling 29 Epidemic influences As an argument for the epidemic influences, Carl Braun does not know any better than to allege that from the ancients on down recourse has been had to the epidemic influences as an explanation of the devastations brought on by puerperal fever, he reproaches me for having leaned on the past and drawn unwarranted conclusion therefrom; I do not reproach him because he has leaned on the past, but I do reproach him when he draws false conclusions from the past

From the ancients on down, epidemic influences were resorted

to as an explanation of the devastations of childbed fever, as a consequence, there exist epidemic causes of childbed fever—a false conclusion. Which explanation is older and which is true? The one which says: the earth stands still, and the sun moves around it, or vice versa?

(p. 532) After Carl Braun establishes the existence of the epidemic influences so unshakeably, he turns out a dissertation of over four printed pages on the contagiousness or non-contagiousness of childbed fever, on the contagium, miasma and infection as a horrible example. What monstrosities one may create, if one compiles without understanding. This chaos we shall leave uncriticized.

Of those causes which are actually causes of childbed fever, there are only, according to my conception: 10 the birth-act itself; 14. protracted labor; 21. operative intervention. The birth-act, protracted labor and operative intervention can cause bruising of the genital organs and thereby the production of decomposed matter, which engenders childbed fever by auto-infection.

17. Increased secretion and excretion of the lochia. Increased secretion of the lochia is not a cause of childbed fever; increased excretion of the lochia causes childbed fever through autoinfection.

19. The injurious influence of a dead fetus Decomposed dead fetuses are not a cause of childbed fever; the fetus which dies during labor and after rupture of the membranes, along with entrance of the atmospheric air into the uterus, undergoes decomposition and engenders childbed fever by auto-infection

24. Persistent thirst according to Carl Braun should cause puerperal fever, because as a result of the thirst absorption, even the absorption of decomposed matter present in the uterine cavity occurs quickly and thus puerperal fever is engendered by auto-infection

25. Extreme room-temperatures and defective ventilation cause childbed fever, because excreted matter during the puerperium undergo a putrid decomposition more quickly.

27. How swamp-emanations can produce puerperal fever is

obvious.

(p 533) 28 Cadaveric infection

30. The heterogeneous unsuitable conditions peculiar to lying-in hospitals. The situation of the lying-in hospital exerts the most powerful influences upon the state of health of its inmates.

Those lying-in hospitals which are separated from the neighboring buildings and are surrounded by spacious gardens show the smallest mortality percentages. The close contact between lying-in hospitals and general hospitals entails the greatest disadvantages, because all lying-in hospitals which are constructed as a part of a general hospital, as a rule present the higher mortality percentages. The juxtaposition with locales, which are occupied by sources of decomposed animal matter, such as deadhouse, junctions of the larger drainage canals, badly kept privies, bad or defective drainage of the latter and dumping of the placentas into them facilitates the spread of epidemics.

The defective construction of most lying-in hospitals along with insufficient ventilation exerts therefore a harmful influence, if the lying-in wards communicate directly with each other and there is no corridor connection; if the rooms are placed right and left of a badly ventilated corridor, if the window-sills are too high, the windows are placed opposite each other and the beds are placed up against the side-walls directly beneath the windows; if the lying-in wards adjoin the sick-wards and are placed over or under them, if ventilation in winter must be accomplished by opening the windows, the renewal of the room-air by hot-air heating is not sufficient, if no ventilators are located near the ceiling of the room, and if these are adjusted for a rapid circulation of the air, not as a "foyer d'appelle" for warming it; if the puerperal invalids are lodged in the vicinity of the lying-in wards, if the puerperae must be brought from the delivery-room into the wards by way of a chilly corridor or stair-case, (p 534) or if the wards for the puerperae are too large and those coming into the wards are arranged in rows

The effluvium of putrefying excrements, as well as the pneumonic exhalations of the puerperae affected with putrid fever, the puerperal odor produced by the co-mingling of many puerperae, lack of isolation of the sick from the well, the omission of

isolation of the sick-wards, the free association of the attendants of the sick patients with those of the healthy, the attendance of midwives or physicians on well patients after the examination or douching of the sick puerperae, the common use of linen, sponges and bed-pans for the sick and the healthy, the long-used and badly-laundered linen, mixing of the linen of the lying-in hospital with that of the general hospital, infrequent change of the mattresses, straw-sacks and the lower cover, the constant use of all the space in a lying-in hospital, the uninterrupted teaching in the overcrowded lying-in hospitals, the difficulty in supervision of a large number of medical students and pupil-midwives, the overcrowding of lying-in hospitals in winter, the epidemic season, the unlimited admission of all healthy and sick gravidae and parturients, the month-long stay of the gravidae in the lying-in hospital, the cramming of the lying-in hospital with unmarried women from the more wretched strata of society, the repeated shifting of the puerperae in the first eight days, the overlong storage of nursling-cadavers or placentas alongside the lying-in wards, the ordinarily too small number of supervising physicians, the continuous mingling of the gravidae with the patients of the general hospital in the common courts, the lodging of parturients affected by zymotic disease in the labor-rooms for the healthy, deficient or onerous supply of water in the upper floors, the over-long or nocturnal sojourn (p 535) of a large number of people in the labor-rooms, the too frequently repeated examinations during protracted labor, lack of a locale sufficient to prevent overcrowding, lack of arrangement for the care of parturients and puerperae in private dwellings at public cost in time of epidemics and overcrowding, the neglected or lack of authorization for the removal of the puerperal invalids from the lying-in hospital during the prevalence of the more frequently occurring diseases; all these drawbacks, which occur separately in the different lying-in hospitals, explain the more favorable or the more wretched results of many lying-in hospitals, are the occasion of the greater danger of illness in them than in private dwellings and lay before our eyes the facts, that the local conditions in many lying-in hospitals which very frequently may be modified

only at great cost, exert a mighty influence on the origin, dangerousness and extension of the puerperal processes"

These irrelevant conditions in the lying-in hospitals enumerated by Carl Braun are either not causes of childbed fever, or even if they are causes of childbed fever, they are such only because through these irrelevant conditions in the lying-in hospitals a decomposed matter is introduced into the patient from without

Therefore these irrelevant conditions engender childbed fever by infection from without

Into a further criticism of Carl Braun's paper "The Doctrine and Treatment of the Puerperal Process and its Relation to some Zymotic Diseases," we shall not go, the reader will have derived from what we have already said the conviction that Carl Brain always teaches error, when he teaches something which does not agree with my teaching, and truth when he restores my doctrine We shall give only the definition of childbed fever, because it is new evidence, whither undigested compilation leads (p 536) According to Carl Braun, childbed fever is a zymotic disease of an acute character, which in the presence of a strong predisposition in the individual can engender decomposed animal matter by a general noxiousness, such as violent emotion, chilling, etc, as a rule by particular influences, miasma, contagion, whereby the extraneous characteristics work as a ferment and set up fermentation by contact in the blood-mass

The reader learns with astonishment that Carl Braun, the same Carl Braun, who so brilliantly attached the hypothesis of cadaveric infection based upon conjecture and lacking every direct proof, who to the satisfaction of every true friend of humanity has so triumphantly robbed the epidemic influences of their unlimited strength, the same Carl Braun allots indeed the decomposed animal, but not the epidemic influences a place in the concept of puerperal fever. O Logic! O Logic! We give therefore our Vienna colleague, while we bid him farewell, the cogent advice, not to neglect to take some semesters of logic as soon as possible, in case he should feel the need to take up the noble calling of battling for the epidemic death of puerperae

(p. 537)

EPILOGUE

I can point to my many years of silence as an unexceptionable proof, that it is not a quarrelsome disposition, which dictates these polemics.

But the unprejudiced reader will have derived from the opposition, which I have the opportunity to place before him, not only the conviction that the time for silence is past, but he will at the same time be convinced of the fact, that it was my duty and my right to so engage in polemics, as I have done

If I look back into the past with my present conviction, then I can banish the melancholy which overtakes me, looking at the same time into that happy future, in which within and without the lying-in hospitals over the entire world only cases of auto-infection will occur. In contrast with these two enormous figures is the number of those who up to now have been saved by me and by those who follow my doctrine, is insignificantly small

But should not it be given to me, which God forbid, to behold this happy time with my own eyes, the conviction that this time will come without fail sooner or later after me, will still soothe

the hour of my death.

ADDENDUM

to p. 85, line 4 from above to page 101 inclusive

In the school-year 1858-9, in which the clinic was in the locality described from p 85 to p 101 as so unsanitary, there were 578 patients cared for, of which there were 577 puerperae and one gynecological case. Of the 577 puerperae, 16 died, 11 from puerperal fever or 1.89%, three from pneumonia, one from pulmonary tuberculosis, one with abdominal typhus was transferred to us from the medical clinic, who died immediately after labor. The first labor took place on October 5, 1858, the last July 19, 1859. 53 accoucheurs took a two-month course and 189 midwives a five-month practical obstetrical course.

In the school-year 1859-60 the clinic was moved to a new location, 524 individuals were cared for, of these there were 520 puerperae, two gynecological cases and two pupil-midwives, who

were cared for in the clinic because of their poverty. Two died, one of pulmonary tuberculosis, one of abdominal typhus

Of the 520 puerperae cared for, 11 died, five from puerperal fever, 1.e 0.96%, among these a case of perforation because of a conjugate of three inches, where the extraction was uncommonly difficult because of the unusual size of the infant

Four puerperae died of pneumonia, one of tuberculosis, one from eclampsia. The first labor occurred on October 8, 1859, (p 539) the last on July 17, 1860. 58 accoucheurs and 199 midwives took instruction.

Although in the new locale we have lost less than one puerperae out of one hundred from puerperal fever, yet we are not satisfied that these five cases were really cases of auto-infection, because the new locale does not conform to all the sanitary requirements; the new obstetrical clinic is situated on two floors and has the surgical clinic on the first floor underneath it. What is still more prejudicial, is that the floor space of the clinic is so restricted that no ward can be reserved as a sick ward, and even if a sick puerpera could be completely isolated from the attendants and the utensils, yet the atmosphere of the sick patient cannot be isolated from the atmosphere of the healthy ones in the same ward, and the carious knee in November, 1847 at the First Obstetrical Clinic in Vienna has taught us to what extent puerperal fever can be spread by way of the atmosphere

These drawbacks in the new clinic do not permit me to make critical observations on the number of inevitable cases of automfection. On this point I must await information from a colleague who, more fortunate than I, directs a lying-in hospital which conforms to all the requirements of my doctrine on the prevention of childbed fever.

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WILLIAM MORRANT BAKER

MEDICAL CLASSICS

VOL. 5

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NO. 9



William Morrant Baker

BIOGRAPHY

- 1839 Born October 20, at Andover, the second son of a solicitor Educated at Andover Grammar School Became apprenticed to a local surgeon, Mr Payne
- 1858 Age 19 Entered St Bartholomew's Hospital Medical School
- 1861 Age 21 Gained senior scholarships On October 1, became Resident in-Midwifery and assistant to Dr West, on whose resignation, Baker was placed in temporary charge of Martha Ward and of Maternity Department of St. Bartholomew's
- 1862 Age 23 Assistant to Dr James Paget in his private practice.
- 1863 Age 24 Assistant demonstrator of anatomy at St Bartholomew's.
- 1864 Age 25. Became a Fellow of the Royal College of Surgeons.
- 1865 Age 26. Became demonstrator of anatomy and physiology at St Bartholomew's Fellow of Royal Medical and Chirurgical Society. Member of Pathological Society of London.
- 1867 Age 28 Elected warden of college. Secretary to the Committee of Medical Officers and Lecturers—"The Medical Committee."
- 1868 Age 29. Married Miss Annie Mills and had 2 sons and 4 daughters.
- 1869 Age 30. Became lecturer in physiology and general anatomy until 1885.

1870 Age 31 Appointed casualty surgeon.

1871 Age 32 Assistant surgeon to St Bartholomew's and later in charge of surgical out-patient room

1875 Age 36 Took charge of Skin Department.

1877 Age 38 Described Baker's Cyst of leg

1878 Age 39. Examiner in Physiology on Board of Royal College until 1887

1882 Age 43. Became full surgeon until 1892

1887 Age 48 Examiner in Surgery until 1892

1892 Age 53 Gave up practice because of poor health. Elected governor of St Bartholomew's Hospital

1896 Age 57. Died December 3 at residence in Sussex, Nutbourne Manor, Pulborough, after a long illness

Also Surgeon to Bartholomew Close Dispensary
Surgeon to Evelina Hospital for Children
Examiner in Surgery at University of London and
Durham University
Member of Clinical and Dermatological Societies

EPONYMS

Over-hernia of the synovial membrane of a joint through an opening in its capsule On the formation of synovial cysts in the leg in connection with disease of the knee-joint St Barth Hosp. Rep, 13. 245–261, 1877 The formation of abnormal synovial cysts in connection with the joints. (Second communication) Ibid, 21. 177–190, 1885

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INTRODUCTION

William Morrant Baker's work on synovial cysts of the leg is a fine example of the idea behind the origin of MEDICAL CLASSICS Many original descriptions of disease, excellent presentations. have been buried and become lost. Other descriptions are now misquoted so that the original meaning and value are missed This publication was formed in order to reprint original papers

of lasting value to the profession

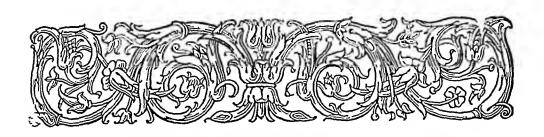
The disease condition described in this number of MEDICAL Classics may be rediscovered at any time This was brought forcibly to my attention a short time ago when a patient with a swelling in the region of the knee was presented at a hospital tu-The swelling was definitely a Baker's cyst of the knee with the synovial cyst pointing beneath the skin in the upper part Many other diagnoses were put forward because the attending doctors were not familiar with Baker's description of this condition Therefore some bright young medical man will probably soon publish a paper on this disease and imagine that he has discovered something new

While an assistant surgeon at St Bartholomew's Hospital and Lecturer in Physiology and General Anatomy, William Morrant Baker, in 1877 at the age of 38, wrote a paper On the formation of synovial cysts in the leg in connection with disease of the knee joint, a condition which has since been called Baker's cyst This paper is in the thirteenth volume of St Bartholomew's Hospital Reports, "the family mausoleum," as the Reports were once called by Sir Thomas Smith, the editor, considering the small group which wrote the papers and the limited circulation they attained

The paper of 1877 includes eight case reports in detail with Osteoarthritis is the underlying condition three illustrations in several of the cases, in others the condition would now be called tabetic arthropathy or Charcot's joint Charcot had described arthropathy in 1865 but the subject had not become widely known D'Arcy Power showed that many of these cysts are part of a tuberculous affection of the joint

Baker's name should be retained in connection with these cysts because of his original description which is here reproduced in the

complete first and second announcements



Baker's Cyst

On the Formation of Synovial Cysts in the Leg in Connection with Disease of the Knee Joint

BY

W MORRANT BAKER

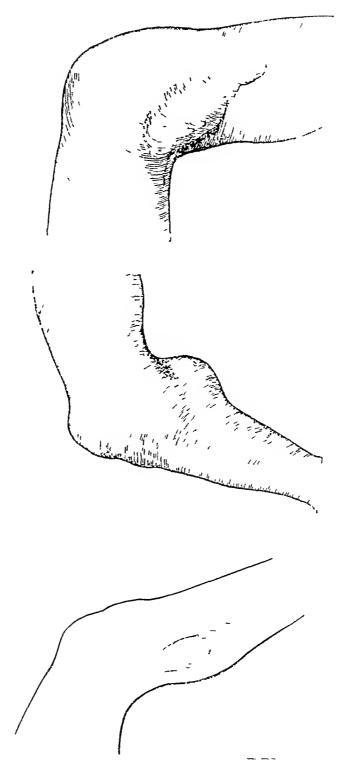
St Bartholomew's Hosp Rep, 13 245-261, 1877

Y ATTENTION was first drawn to the diseased condition which forms the subject of the present paper by the following case, which was under the care at different times of my colleagues, Mr Callender and Mr Marsh, and of myself For the notes of the case I am indebted to the records of the Surgical Registrar, Mr Butlin

CASE I

Large Cyst in the Calf of the Leg—Osteo-Arthritis of Knee-Joint—Amputation

A woman (M S), 38 years old, was admitted into St Bartholomew's Hospital, under the care of Mr Howard Marsh, July 22, 1873, with a large swelling in the calf of the right leg The right leg was about twice as large as the left, from Just above the knee to the ankle. There was slight edema, and the superficial veins looked tortuous and dilated. There was no great pain or tenderness, and no hardness or swelling could be felt in the track of the popliteal vein. The swelling was generally uniform, but especially marked in the calf, where deep-seated fluctuation could be felt. A slight pulsation was also perceptible, but was apparently only transmitted. There was also some effusion in the knee-joint.



EXPLANATION OF PLATES

Fig a (Bottom) Diagrammatic representation of the cyst in the calf of the leg, referred to in the text. The drawing is from memory only, as unfortunately no drawing or cast of the diseased part was taken at the time at which the patient was under my care

Fig b (Center) Drawing of knee-joint and calf of the leg of G R, Case V

Fig c (Top) Cyst of the Leg, W T, Case VIII

(p 246) The patient was thin, but otherwise in fair health and complained only of numbness and very slight pain in the leg.

The history given by the patient was that five months ago the right leg began to swell, and had continued since slowly increasing. She thinks that, as she stooped one day, something cracked in the knee, and from that time it began to swell She has had swelling of the leg after each confinement

At a consultation which was held on the case, it was generally agreed that there was a quantity of fluid, perhaps pus, beneath the superficial calf-muscles, with probably thrombosis of the deep veins

A day or two after the patient's admission into the Hospital, the swelling in the calf was punctured by Mr Marsh with a very fine trocar, and several ounces of fluid were drawn off, leaving behind a considerable amount of thickening. Much to the surprise of those present, the fluid was not purulent, but apparently cystic. It was translucent, pale red, viscid, slightly turbid and alkaline. It contained a large amount of chlorides, and was almost solidified by heat and nitric acid. Microscopic examination failed to detect more than the presence of blood corpuscles, there were no pus-cells

July 28—The fluid has apparently collected again. The measurement of the right calf is $13\frac{5}{8}$ inches, that of the left, $9\frac{5}{8}$ inches. There is no enlargement of the femoral or inguinal glands. The swelling and thickening of the leg seems to be chiefly in the upper part of the gastrocnemius, especially in front of the muscle, and in its external head, and between the two heads, as well as some three or four inches lower.

The swelling below the calf is probably only oedema, on account of the pressure above

July 31—The swelling in the lower part of the leg is much diminished

Since her admission the patient has been unable to retain either urine or faeces, which all pass involuntarily. This has been so, it is said, for some time past. An examination of the vagina and rectum, however, has discovered no abnormal condition, and throws no light on the condition of the leg

August 4—The leg is generally much smaller and less painful

Measurement of the calf is 12 inches The condition of the knee is not changed

August 16—The thickening in the upper part of the calf is much less The knee is bandaged

September 5—There is still some thickening in the upper part of the calf. The knee, in spite of careful and constant bandaging, is gradually increasing, apparently on account of (p 247) fluid in the joint The leg is now abducted and slightly everted

September 17—The thickening in the upper part of the calf is apparently permanent, but not manifestly increasing. The knee is still enlarging. The patella is now much displaced outwards, and the leg is still more abducted and the foot everted. It seems as if there were some enlargement of the upper end of the tibia or the lower end of the femur. Measurement around the knee is $15\frac{1}{2}$ inches, and around the lower end of the femur, 16 inches.

Soon after the last note the patient left the Hospital, but was readmitted in August 1874, under the care of Mr Callender, on account of the condition of her knee-joint. In his absence she was for a time under my care, and I had many opportunities of observing the state of her limb

Since she had left the Hospital, the swelling of the knee had to a great extent subsided. About two months, however, before her readmission she fell down, and from that time the leg has been "out of place," and dangling loose and useless. There has not been very much pain. At the time of her readmission the right tibia was found dislocated outwards and backwards, and the leg hung loose and flail-like. It could be twisted easily in all directions, and even replaced in fair position, from which, however, it at once reverted to its mal-position when restraint was discontinued. The bones grated at the knee-joint, as if they had lost their cartilage. The synovial membrane was not now very much thickened, and there was no pain or tenderness, even on free movement.

The whole of the extremity was atrophied No trace of the cystic disease of the calf, or even of thickening in this part, could be detected

Attempts were made to improve the position of the dislocated bones, and to give such mechanical support as would enable the limb to be used, but without success, and amputation of the thigh was performed by Mr Callender in January 1875

Examination of the limb after removal—The joint-surfaces were found in great part denuded of cartilage, smooth and eburnated, having nodules of bone growing out from their edges Portions of the cartilage remaining were soft, vascular, and pulpy The ligaments had been almost wholly destroyed The synovial membrane was thickened, many of its processes standing out on its interior like small firm fibrinous nodules A considerable quantity of viscid fluid was in the joint

No trace of the cyst in the calf could be discovered.

On thinking over this case, it seemed to me more than (p 248) probable that the supposed cyst in the calf of the leg was formed really by a collection of fluid which had escaped from the interior of the knee-joint. The character of the fluid, the progress of the case as it developed, and the total disappearance of the cyst, so that even on examination of the limb after removal no trace of it could be discovered—all seemed to favour this view of its nature

The following case, which I met with not very long afterwards, confirmed me in this idea

CASE II

Osteo-Arthritis of Right Knee-Joint, with Cystic Tumour at Upper and Inner Part of the Calf of the Leg

October 1875—The patient, a man (J S), 52 years old, came to my Out-Patient Room at St Bartholomew's Hospital on account of disease of the right knee. There were the usual symptoms of chronic rheumatoid arthritis, with a considerable amount of fluid in the joint, and the tissues seemed very tight, as if the fluid were under considerable pressure. The leg could be extended almost completely, but it could not be flexed beyond a right angle with the thigh. At the upper and inner part of the calf, and quite distinct from the swelling in the knee-joint, was a circumscribed oval swelling, measuring about two inches in length by three-quarters of an inch to an inch in breadth. Its long axis

corresponded with that of the leg, and beginning four inches below the lower border of the patella, it extended along the inner edge of the gastrocnemius, slightly posterior to the inner border of the tibia.

It felt elastic, as if from the presence of fluid rather tightly confined within it, and seemed seated in the subcutaneous (p 249) tissue, the skin over it not being altered in any way. By firm pressure the fluid could be pressed apparently along what seemed a narrow prolongation of the tumour, leading off like a small canal in the direction of the knee-joint, but I could not trace this prolongation of the cyst quite to the joint, nor could I feel fluctuation distinctly transmitted by finger-pressure from the fluid within the knee-joint to that in the cyst. The contents of the cyst could not, moreover, be pressed out of it, the only effect of even firm pressure being to squeeze a certain amount of fluid along the small channel just referred to. The sensation given to the fingers was quite that of a closed cyst or cavity. Little or no pain was caused by the manipulation

The patient first noticed a swelling of his right knee six months ago. The knee ached, especially on exertion, and has done so ever since. It was also stiff, and the stiffness has increased about a fortnight after the first appearance of the disease, he came to the Hospital, and had a bandage applied, but did not apply for relief again until the present date. He used his leg up to this time

About a week ago he first noticed the swelling on the inner side of the calf It has not given him any pain or inconvenience, but

has considerably increased in size.

The knee not improving under treatment in the Out-Patient Room, I admitted him for a short time into the Hospital At this time (November 3) the right knee measured 14 inches round, and the left 12½ inches Under the influence of rest, strapping of the knee, and bandaging, the condition of the joint improved, and he was discharged in about a month

December 20—The patient came to the Out-Patient Room to-day. The knee was still swollen and rather tender, the general condition of the joint resembling that characteristic of chronic

osteo-arthritis

The cyst on the inner side of the calf was still present, but it seemed much more lax than heretofore, so that on firm pressure it could be nearly flattened out, but this seemed to occur rather from the laxity of its walls than from the pressure driving the fluid elsewhere The popliteal space felt more full than that of the opposite leg; but I could not detect, on pressure, any fluctuation between either the popliteal space or any part of the knee-joint and the cyst

The knee was again strapped and bandaged

June 1876—At this date I again saw this patient, and found that the cystic swelling of the leg had disappeared, and, he said, for a long time past

The knee was still stiff, and the subject of chronic osteo-

arthritis

(p 250) Taken in connection with Case I, I did not doubt that in this case the cystic tumour of the leg was caused by the escape of expectable that the state of all large than the state of the state o

of synovial fluid from the distended knee-joint

I am indebted to my colleagues, Mr Holden, Mr Callender,

Mr Thomas Smith, and Mr Willett, under whose care the following cases occurred, for permission to record them The details of Cases III, V, and VI are quoted from the notes of Mr Butlin, whom I have also to thank for informing me of their admission into the Hospital

CASE III

Cystic Tumour of Calf of Leg—Puncture—Subsequent Acute Inflammation and Suppuration of the Knee-Joint

A man (J H), 53 years old, a surgical instrument-maker, was admitted into St Bartholomew's Hospital, under the care of Mr Holden, November 27, 1875, with the following history —About a month ago he first noticed a swelling in the calf of the leg, which has been slowly increasing ever since The redness, which was for some time present, has now passed off

On admission, there was found a considerable tender swelling of the calf of the right leg, especially prominent at the upper and

inner part, three or four inches below the knee-joint

Under the impression that it was an abscess, it was punctured

by the House-Surgeon, when there escaped a greasy fluid containing a number of flakes and masses of lymph, but no pus It was thought at the time, in the absence of any other suggestion, that the disease might be a hydatid cyst; but a diligent microscopic search failed to find any evidence of this

November 29 (two days after admission)—There is no discharge from the opening, which is surrounded by a wide area of superficial inflammation. The calf is generally much swollen,

very painful, and tender

November 30—Suppuration has commenced within the cyst Temperature, 101 2° There is also now slight effusion into the knee-joint. No affection of the joint was noticed until to-day; and the patient states that there was nothing wrong with his knee before his admission into the Hospital

December 3—The knee-joint has been very tight during the last day or two, on account of effusion within it, but the inflammation of the calf has passed off There is free discharge from

the wound Temperature normal

(p. 251) December 6—Pus mixed with synovia-like fluid escapes now freely, and can be made to issue from the wound in the calf by making firm pressure for a second or two on the knee-joint. The knee is rather less swollen and tense, but it cannot be straightened, nor can any attempt be made to do so without causing severe pain. The patient's general condition is good.

December 28.—Nothing worthy of special remark has occurred since the last note. It has been evident that there is a tolerably free communication between the cavity of the knee-joint, and the interior of the cystic swelling in the calf. Now there is scarcely any discharge from the opening, and what passes is like synovia. The leg has been bandaged, and is now much reduced in size, but the knee remains much swollen and somewhat flexed. A weight of 4 lb has been applied to the leg in order to straighten the knee.

January 8, 1876.—The wound is soundly closed Knee to be

strapped with Ung hyd co

January 19—The joint is strapped as before, and the swelling is much diminished, although the knee is still contracted. The weight has been left off.

The patient was discharged from the Hospital, January 29.

I saw this patient again about a month after he left the Hospital At this date (March 2) the knee was still somewhat swollen, but it seemed more like the swelling of rheumatoid arthritis than that of simple chronic synovitis. It was not hot or specially tender Movements of flexion and extension could be performed over a considerable range. There was grating like that of rheumatoid arthritis when the joint-surfaces were pressed together, and some pain at the same moment. The ligaments seemed weakened or in part destroyed, so as to permit too free rotation of the tibia. The knee is still somewhat flexed. The patient said the joint was still too weak for walking, and he had not yet returned to work

The scar of the puncture in the calf was soundly healed. It was about four inches below the knee-joint, on the inner side of the leg

There was no swelling of the calf, not the slightest indication of any connection of this part of the leg with the interior of the knee-joint. The integuments were also perfectly normal in every respect

(p 252) CASE IV

Cyst in Upper Part of the Calf of the Leg—Insertion of Seton— Inflammation of Knee-Joint—Amputation

This case, it will be seen from the dates, occurred some years before either of my own, but I was not aware of the facts until Mr Willett kindly offered me the notes for addition to those which I had previously collected

The patient (J M) was a man 23 years old, who was admitted from the Out-Patient Room into St Bartholomew's Hospital, under Mr Willett's care, February 8, 1869, on account of a prominent swelling situate at the upper portion of the calf of the left leg, where the two heads of the gastrocnemius unite

The history given by the patient was that two years ago he sprained the left knee, which has remained weak and slightly swollen. The popliteal swelling commenced eight months ago It was not painful, but caused inconvenience by its size.

"On examination, the synovial membrane of the left knee-joint was found thickened, but there was no excess of fluid in its sac, and the joint was in a perfectly quiescent state. The tumour lay

precisely at the lower angle of the popliteal space, overlapping the united gastrocnemius muscle, and was of the size and shape of a Tangerine orange. It was tense and fluctuated. Pressure did not reduce its size."

"A suspicion naturally arose in my mind," Mr Willett continues, "as to a possible communication between the synovial membrane of the knee and the popliteal cyst, but it seemed negatived for these reasons—(1) By their relative positions, (2) the apparent complete isolation of the cyst; and (3) the absence of fluid in the knee-10int The conclusion I came to was that the cyst was of a bursal character, and as a precautionary step I tapped the swelling with a trocar A clear, slightly viscid fluid was drawn off, and the cyst was emptied so completely as to disappear The patient kept about, the knee being unaffected, but at the end of ten days the swelling was nearly as large as I therefore resolved to attempt a radical cure, and with this object introduced, as a seton, a couple of silk threads measure was almost immediately followed by rapid synovitis of the knee-joint, with acute local inflammatory symptoms, and violent constitutional disturbance, excessive pyrexia, and de-The threads were removed at the end of twenty-four hours, but the febrile symptoms did not abate until the cyst was laid open, while diffuse suppuration in the calf and popliteal space followed, with, in the end, complete disorganisation of the (p 253) knee-joint Amputation through the thigh was performed on the 14th of April, and the patient made a good recovery

"The limb was carefully dissected, but it was impossible to trace the track of the communication, which evidently must have existed, between the knee-joint and the cyst, on account of the

disorganisation of all the structures concerned"

CASE V

Osteo-Arthritis of Right Knee-Joint, with Large Cystic Swelling of the Calf of the Leg—Amputation

A man (G R), 56 years old, was admitted into St Bartholomew's Hospital, under the care of Mr Thomas Smith, June 2,

1876, on account of disease of the knee of three years' duration. The knee had become much worse during the last three or four months. The calf of the leg also has become swollen and the swelling has extended to the foot.

At the time of admission into the Hospital, it was evident that there was extensive disease of the right knee-joint. The leg lay bent almost to a right angle with the thigh, and could not be straightened, and only slightly flexed. All movement was painful. The patella was scarcely moveable. There was evidently effusion into the joint, with thickening of the synovial membrane. Fluctuation was distinct on each side of the patella, and there was a large bulging and fluctuating swelling above the patella, on the outer and front aspect of the thigh. Fluctuation was distinct, extending from this part across to the front and inner aspect of the joint, beneath the common extensor tendon. There was some tenderness about the joint, but no marked increase of temperature.

(p 254) In the upper part of the calf of the leg, and in the popliteal space, projecting markedly on the inner side, was a large, tender, irregular, and fluctuating swelling (fig b) Fluctuation could not, however, be communicated to the fluid in the knee-joint by pressure on this swelling in the calf The lower part of the leg and foot were also much swollen and oedematous The tibia was a good deal displaced backwards, but could be drawn forwards, with the occurrence, at the moment, of a sharp jerk or snap, as if the ligaments had been destroyed

The patient's health was but little, if at all, interfered with

At a consultation which was held on the case, it was generally agreed that the only hope of relieving the patient lay in amputation of the thigh, and this operation was performed by Mr Smith, July 1st

Examination of the limb On examining the leg after removal, the cavity of the knee-joint was found much increased in size, and containing several ounces of curdy purulent fluid The cartilage was ulcerated, especially over the head of the tibia The synovial membrane was thickened and pulpy The bones were slightly softened beneath the diseased part of the cartilage One or two

small excrescences, similar to those usually found in cases of osteoarthritis, were discovered, and there was eburnation of the articular surface of the femur, characteristic of the same disease

The fluctuating tumour of the calf of the leg, which lay beneath the gastrocnemius, was formed by a large cavity, containing a precisely similar fluid to that which distended the knee-joint This cavity communicated with the joint through a narrow which extended upwards along the back of the tibia

CASE VI

Chronic Disease of the Knee-Joint-Large Cyst in the Calf

January 6, 1877—A woman (S A S), 47 years old, was admitted into St. Bartholomew's Hospital to-day, under the care of Mr. Callender, with the following history—

She has suffered from slight disease of the left knee-joint for the last five years, but although it has been sometimes better, sometimes worse, she has been able to get about without much discomfort, or even a stiff knee. Five weeks ago she was attacked with rheumatism in the right shoulder, then in the left, and in the left knee. Since that time the affected knee has been much swollen and painful

Three weeks ago a swelling began to form in the left calf, and (p 255) has been very painful, but without any corresponding change for the better or worse in the condition of the knee-joint.

She has been "bodily ill" during the last five weeks.

There is now swelling of the left knee-joint, which is apparently the seat of old-standing chronic inflammation. The synovial membrane is thickened. The knee is slightly flexed, and cannot be extended. There is pain on movement, but not at other times. There is some increase of temperature of the affected joint, and tenderness on firm pressure.

There is a large fluctuating swelling in the calf of the leg, the fluid seeming, on palpation, to be just beneath the integument. The swelling is not more prominent on one side of the limb than the other, and is not painful or tender. On pressure, no fluctuation can be felt extending from this swelling to the knee-joint, or

vice versa

The patient is sallow, and evidently much out of health Tongue coated, breath foul, acid perspirations

January 12—To-day the calf was punctured with a grooved needle, and some clear viscid fluid, apparently synovia, was let out There was no pus

January 13 —There is some pain and swelling about the right

January 16—The patient's general condition is much worse than the condition of the knee and calf of the leg seem to warrant Her breathing is quick and jerky, there is frequent cough, and great prostration

On examination of the chest, Dr Southey found signs of slight lobular pneumonia in the subscapular region, with some impaired resonance beneath the left clavicle T 100 6°.

January 19—An incision was made in the calf, and the cavity washed out with a lotion of carbolic acid (1 to 30) The fluid which escaped on making the incision consisted apparently of synovia, mixed with a little thin pus, and some curdy matter. The injection did not apparently pass into the interior of the knee-joint Temperature before the operation, 100 2°.

January 20 —T 99°

January 25—No discharge of fluid takes place from the cavity in the calf of the leg, but an ounce of carbolised lotion can be injected into it

January 29 —The cavity is again discharging

February 9—The quality of the discharge, which still continues, varies from time to time, being sometimes purulent, sometimes clear

February 15—The patient has been worse to-day, and has suffered much pain in the knee during the last few days Temperature (p 256) in the morning 998°, in the afternoon, 102.6°. An erysipelatous blush was noticed over the calf and back of the knee

After a sharp attack of erysipelas, which nearly proved fatal, the patient is reported (March 1st) to be better, the integuments of the leg wrinkling, and losing their red colour

March 12 —All signs of erysipelas have now passed off.

March 21 —During the last few days the patient has had some ascites. The opening in the calf is now quite closed. The knee is in much the same condition as at the time of her admission into the Hospital.

On March 26 the patient was transferred to a medical ward

November 5, 1877—I saw the patient again at this date. She was looking healthy and strong, and was able to walk well with the aid of one stick or crutch. The knee-joint was still somewhat swollen, bulging as if from thickened synovial membrane rather than from much fluid within. The leg could be flexed and extended, but a good deal of creaking and fine crepitus could be felt by the hand at the same time. The joint seemed, the patient said, to "go in and out."

Except some slight firmness in the calf, as if the tissues were condensed by past inflammation, no trace of the large cystic swelling could be found. All seemed soundly healed, and only a small scar remained to show where the puncture had been made.

CASE VII

Effusion into the Knee-Joint with Fluctuating (Synovial?) Tumour in the Popliteal Space and Calf of the Leg

A man (W M), aged 49, came to my Out-Patient Room, December 4, 1876, with an enlarged and very tense knee-joint, from thickening of the synovial membrane, with effusion. The popliteal space seemed also tense and swollen, and the calf of the leg was affected in a like manner. When pressure was made on the calf, there was a sense of fluctuation, at the same time that a marked swelling on the inner side was produced, resembling that which was present in some of the cases previously narrated

The disease in the knee began about three and a half years ago, from no assignable cause, the joint reaching its present size in about a year and a half, and not altering much since that date. The calf had been swollen about twelve months

October 1877 —I did not see this patient again, and on inquiry at his address at this date, found that he had died of "general debility" in June or July last Since attending at St Bartholomew's Hospital, he had been admitted into (p 257) Guy's

Hospital, under the care of Mr Howse, and to him and to Mr. Frederic Durham I am indebted for the following additional

particulars of his case

"He was in Guy's Hospital from April 28 to May 23 At this time there was an enormous amount of effusion into the knee-joint, extending for some distance (nearly half-way) up the thigh It was tapped twice by Mr Howse, 12 oz and $8\frac{1}{2}$ oz of fluid being drawn off The fluid contained flakes of caseous material

"There was also a large fluctuating swelling below the knee, extending more especially over the inner surface of the tibia, and later on down the inner side of the calf

"The case was looked upon as one of very advanced chronic osteo-arthritis"

CASE VIII

Cyst in the Leg of Uncertain Nature

The following case, which I have found among my notes, may be here inserted for the sake of the accompanying drawing, which was made at the date of my seeing the patient. It doubtless belongs to the present group of cases, but the note is too fragmentary to be of much service. So far as I can remember, or gather from my notes, the patient was seen only once, and nothing is stated regarding the condition of the knee-joint

W T, aged 62, came to my out-patient room November 4, 1872, with pain in the outer part of the thigh. While examining his leg my attention was accidentally drawn to a cyst-like swelling at the upper part of the calf, just below the knee. It was tense, and evidently contained fluid, and from its lower part was a short and slightly tortuous cord, (p. 258) somewhat like an obliterated varicose vein. The skin over the parts was not at all altered in colour. The patient had noticed the swelling for above ten weeks

The route which is taken by the fluid, when making its way out of the knee-joint to form an artificial synovial cyst in neighbouring tissues, is probably one determined by definite anatomical conditions. What anatomical arrangement is, however, most

often concerned in guiding the fluid on its way, I cannot at present say

In the only one of the cases already related in which there was an opportunity of examining with reference to this point, Mr Butlin could only find a sinus running up to the back of the joint, and could not determine precisely its relations.

In the case of a little girl, whose leg was amputated by Mr Callender in December 1875, on account of acute inflammation and suppuration within the knee-joint, and in which a large abscess had formed in the upper part of the calf, I found on subsequent careful examination of the limb that the abscess-cavity in the leg communicated with the interior of the joint by a narrow channel, which seemed to track by way of the tendon of the semi-membranosus muscle and its bursa, and there can be little doubt that the abscess, like the synovial cysts here described, owed its origin to fluid, doubtless in this instance puriform, which had escaped from the joint

The late Mr. Wormald taught that the synovial membrane of the knee-joint was thinnest, and, therefore, most likely to give way under distension at the spot at which it partially encircles the tendon of the popliteus muscle, and Mr Holden¹ states that there is a bursa under this tendon which generally communicates with the interior of the joint. It is quite possible, therefore, that the tendon of the popliteus may form sometimes a guide for fluid which is making its way out of the knee-joint, but further experience is necessary before a positive opinion could be expressed on this point.

In some cases, probably, there is a communication between the interior of the knee-joint and a bursa, the walls of which, having been first distended from the joint as far as they can bear, give way and permit their fluid contents to track along the limb.

It is somewhat curious, however, that in neither of the cases here related has the position of the cyst corresponded exactly with that of any normal bursa. It might have been expected that, at least in some instances, there would have been a special enlargement of one of those connected with the tendon of the

¹ Manual of Dissection, 3d ed, p 490

(p 259) semimembranosus muscle, but such a condition was not observed, unless Case VIII be an exception; a swelling in the situation of the bursa being either not perceptible, or, if present, being merged in a much more extensive swelling, which involved neighbouring parts also. At an earlier stage of the disease it is quite possible that a noticeable enlargement of one of the normal bursae might have been found to precede the larger or more distant artificial synovial cyst, which alone was manifest when the patients came under observation

What connection, if any, the cases here related may have with the herniae of the synovial membrane, described by some authors, it is impossible to say. It may be assumed, perhaps, that the production of synovial herniae may sometimes be the first step in the production of artificial synovial cysts of the leg, and that the fluid which tracks from the joint may escape by rupture of one of these hernial sacs, as it might from the ruptured wall of an over-distended normal bursa. But this is a mere suggestion. I have at present no facts wherewith to support it.

In an interesting article on popliteal cysts,² which I had over-looked until this paper was in type, M Foucher refers to the occasional co-existence of hydrarthrosis of the knee with enlarged popliteal bursae, and records six examples In one of these the enlarged bursa was on the outer side of the popliteal space, in three on the inner side, and in two the position was median. The description of one of his cases corresponds to some extent with Case VIII. here related M Foucher considers it to have been an instance of enlargement of the bursa, common to the semi-membranosus and inner head of the gastrochemius muscles. He refers to one example only of escape of fluid from a bursa into the tissues of the limb. The case was that of an officer, who first noticed a small swelling in the inner side of the popliteal space, three days after a forced march on a rough road. The tumour only very gradually increased. About eighteen months after its first appearance a sudden effort at extending the leg

¹ See Bilroth's Surg Patholog, Transl by C. E Hackley, M D, 1874, p 499, where a drawing is given after W Gruber

² Archives Générales de Médecine, 1856, vol 11 ser v tome 8

caused a rupture of the wall of the cyst, the tumour disappearing at the moment, at the same time that the calf of the leg began to swell. A bandage was applied, but the patient was not laid up. Two years afterwards the cyst was larger than ever, and for a short time the patient was obliged to lay up, as a part of the fluid contents of the cyst, after a tight bandaging, had on tended on both sides of the knee (p. 260). Ultimately the disease disappeared. The knee-joint appears to have been unaffected, and the case therefore had only an indirect bearing on the subject of the present paper.

M Foucher appears not to have met with any instance of extension of fluid from the knee-joint beyond the limits of distended bursae, and, indeed, seems to doubt the existence of any close relationship, in regard to cause and effect, between hydrarthrosis and popliteal cysts, in the examples of the combination of the diseased conditions which he records "Quant à l'hydrarthrose, considerée comme cause efficiente", he is speaking of the etiology of popliteal bursae, "nous ne lui accordons pas la moindre importance" In two of the six cases, moreover which he relates, the enlargement of the bursa proceded that of the knee, and in the remaining four the articular synovial membrane was but slightly distended "We must therefore conclude," he adds, "that the piesence of hydrarthrosis is but a coincidence, although its appearance preceding that of the tumour lends some little probability to the opinion that a synovial hernial cyst may occasionally be present"

The passage of fluid from the interior of the knee-joint into the bursa beneath the inner head of the gastrocneumius muscle, in cases of chronic osteoarthritis, is referred to by Athol A Johnstone 1

Abscesses in the calf, as the result of the escape of pus from the knee-joint are much less rare than artificial synovial cysts. The comparative rarity, however, of their occurrence in connection with disease of the knee makes the following note, kindly written to me by my colleague, Mr Howard Marsh, especially interesting

¹Holme's System of Surgery, 1870, vol 1v p 92

in connection with the cases which are more particularly the

subject of the present paper.-

"December 15, 1875—There is a child now under my care, who, I believe, is an example of the class of cases you were mentioning the other day, in which fluid, originally formed in a joint, tracks away, and seems unconnected with the articulation. The child is about three years old. Some few weeks ago the knee was distinctly swollen, and hot, and lame, and a doctor who was consulted said it was the seat of disease. I saw it a few days ago, and then it had a distinctly circumscribed chronic abscess in the calf, just below the insertion of the Sartorius and its neighbouring tendons, with no sign of joint-mischief except a slight degree of puffiness, and very slight heat. I opened the abscess, and now the joint seems quite normal."

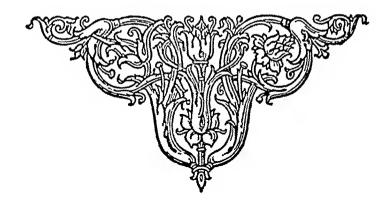
(p. 261) The following are the conclusions deducible from the foregoing cases —

- I That in cases of effusion into the knee-joint, and especially in those in which the primary disease is osteo-arthritis, the fluid secreted may make its way out of the joint, and form by distension of neighbouring parts a synovial cyst of large or small size
- 2 That the synovial cyst so produced may occupy (a) the popliteal space and upper part of the calf of the leg, or may (b) be evident in the calf of the leg only, projecting most, as a rule, on the inner aspect of the leg, or (c) may be perceptible only at the upper and inner part of the leg as a small defined swelling, not approaching within three or four inches of any part of the kneedoint
- 3 That however large the synovial cyst may be, fluctuation may not be communicable from it to the interior of the knee-joint, but the absence of such fluctuation must not be taken to contraindicate the existence of a connection between the joint and the cyst
- 4 That the synovial cyst may be expected to disappear after a longer or shorter period, without leaving traces of its existence, even on dissection of the limb

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- 5. That the cyst should not be punctured or otherwise subjected to operation, unless there appear strong reasons for so doing, inasmuch as interference may lead to acute inflammation and suppuration of the knee-joint
- 6. That most often the disease in the knee-joint will be found to have begun some time before the appearance of the secondary synovial cyst, but sometimes the patient's attention may be first drawn to the latter, or the cyst may seem for a long period the more important part of the disease

THE END





Baker's Cyst

The Formation of Abnormal Synovial Cysts in Connection with the Joints

(Second Communication)

BY

W MORRANT BAKER

St Bartholomew's Hosp Rep, 21 177-190, 1885

N THE 13th volume of the St Bartholomew's Hospital Reports I drew attention to the formation of synovial cysts in the leg as a consequence of disease, especially osteo-arthritis, of the knee-joint, and I ventured to deduce from an examination of the cases there related the following conclusions.—

- I That in cases of effusion into the knee-joint, and especially in those in which the primary disease is osteo-arthritis, the fluid secreted may find its way out of the joint, and form by distension of neighbouring parts a synovial cyst of large or small size
- That the synovial cyst so produced may occupy (a) the popliteal space and upper part of the calf of the leg, or may (b) be evident in the calf of the leg only, projecting most, as a rule, on the inner aspect of the leg as a small defined swelling, not approaching within three or four inches of any part of the knee-joint
- 3 That however large the synovial cyst may be, fluctuation may not be communicable from it to the interior of the knee-Joint, but the absence of such fluctuation must not be taken to

contraindicate the existence of a connection between the joint and the cyst

- 4 That the synovial cyst may be expected to disappear after a longer or shorter period, without leaving traces of its existence, even on dissection of the limb
- 5. That the cyst should not be punctured or otherwise subjected (p 178) to operation, unless there appear strong reasons for so doing, inasmuch as interference may lead to acute inflammation and suppuration of the knee-joint
- 6 That most often the disease in the knee-joint will be found to have begun some time before the appearance of the secondary synovial cyst, but sometimes the patient's attention may be first drawn to the latter, or the cyst may seem for a long period the more important part of the disease.

In the course of the eight years which have elapsed since the publication of my paper, I have met with many other cases of these synovial cysts in connection with the knee, and have found the preceding conclusions amply confirmed by further experience.

With reference to the route taken by the synovial fluid when escaping from the interior of the joint, I suggested in my former communication that it is probably one determined in many cases by definite anatomical conditions, especially those connected with the tendons respectively of the semi-membranosus and the popliteus muscles, although in others the starting-point may be a "hernia" of the synovial membrane in some other situation

The following account of two dissections, since made by Mr D'Arcy Power, appears to show that the suggestions then offered were correct —

The first case was that of a man (under the care of Mr Thomas Smith), aet 44, who had suffered from pain in the left knee-joint for a period of two years before its amputation "At some time between March and October 1884 a swelling appeared in the calf of the leg, behind and below the head of the fibula In October the swelling was punctured and a few drops of blood with some glairy fluid were removed, but there was no pus. He stated that many years before he had rheumatism in his shoulder

On admission into St Bartholomew's Hospital his symptoms were recorded by Mr Bowlby as follows.— 'The knee is stiff, and, as the patient lies, the leg is at right angles with the thigh The head of the tibia is enlarged and the patella is displaced outwards A fluctuating swelling about the size of half an orange is situated behind and below the head of the fibula, extending into the popliteal space A sinus in the middle of this swelling constantly discharges pus The skin over it is red and inflamed' "On opening the knee-joint after amputation of the leg, about

half an ounce of pus escaped

"The cartilage covering the external condyle of the femur is ulcerated in patches"

"The synovial membrane is much thickened, and in parts has grown over the upper portion of the femoral condyles slightly pedunculated, the tufts of synovial membrane being well defined The crucial ligaments are destroyed There is no lipping or eburnation of the bones in any part, and the cartilage, upon microscopic examination, does not appear to be fibrillated

"On the outer side of the spine of the tibia is a passage through which a probe can be passed downwards, backwards, and slightly inwards, through the posterior ligament, into a sac containing about four ounces of a thick curdy pus"

"The cyst lies beneath the gastronemius muscle in the situation of the popliteus. It is, I believe, the popliteus muscle, which itself has been gradually distended until all traces of muscular substance have disappeared "

"Near the outer edge of the plantaris, at the back of the joint, is a well-marked hernia or pouch of the synovial membrane, which has protruded between the fibres of the ligamentum posticum"

Mr Power comes to the conclusion that in this case the formation of the cyst in the leg was preceded by that of a hernia of the synovial membrane of the knee-joint, and that "as the swelling increased in size its course was directed by the popliteus muscle."

In the second case, that of a girl, aet 22 (under the care of Mr Langton), "On the inner side of the leg, commencing at a point two inches below the inner condyle and extending downwards for about six inches, was a fluctuating swelling. This swelling, the patient said, had existed for about six weeks, and was getting larger. The skin over it was normal. No communication could be detected between the swelling and the knee-joint. The swelling was punctured, and three ounces of puriform viscid fluid were drawn off. Three weeks later the swelling was again punctured, and an ounce of very viscid fluid was with difficulty removed."

(The preceding note was made by Mr J L Hewer)

"The leg was amputated Subsequent dissection showed that, as in the previous case, the joint was completely disorganised"

"The bones showed no signs of rheumatoid change, and no history of rheumatoid or other affection could be obtained from the patient

"On the posterior surface of the joint two openings are visible. The one situated at the back of the internal condyle, immediately above the inner head of the gastrocnemius, is large (p 180) enough to admit a lead pencil. The opening is part of a canal which lead from a cyst into the connective tissue surrounding the muscles at the back of the thigh."

"The second aperture is situated in the tendon of the inner head of the gastrocnemius, it is somewhat below and a little to the inner side of the preceding, and is in communication with the cyst. By an opening in communication with this channel a connection is formed between the cyst and the knee-joint, through which a probe can be passed beneath the internal condyle of the femur."

"The cyst measures 4 by 3 inches It appears to have been formed by an enlargement of the bursa which naturally exists beneath the semi-membranosus muscle, and in this instance may have communicated with the knee-joint. The enlargement has taken place in the connective tissue on the inner side of the gastrocnemius muscle, and some of the fibres of this muscle form its inner and posterior wall."

My object in the present paper is to direct attention to the

¹Trans Path Soc of London, Vol xxv1, 1885.

fact that abnormal synovial cysts are formed in connection with other joints than the knee, that, like those met with in connection with the latter joint, they may present many difficulties in diagnosis, and that these difficulties may lead a surgeon astray as to both prognosis and treatment

At the time of my previous contribution on this subject to the Hospital Reports, I had not noticed the disease except in the neighbourhood of the knee Since that period, I have seen it in connection with the shoulder, the elbow, and the hip joints Regarding the wrist-joint and the ankle, I am not so sure In connection with the former I can recall one case at least, which was probably identical in nature, but it occurred many years ago, and I have not preserved any detailed record of it

CASE I

Disease, probably Osteo-Arthritis, of the Right Shoulder-Joint, with Consecutive Synovial Cyst in the Upper Arm

A healthy-looking man (E S), aet 24, was admitted, under my care, into St. Bartholomew's Hospital on September 26, 1883, on account of a fluctuating swelling, supposed to be an abscess, in the upper arm He had applied at the surgery on the previous day, complaining of the swelling in the arm, and stating that three months ago he first noticed pain, which struck upwards to the shoulder Soon afterwards he noticed the lump, of about (p 181) the size, at that time, of a hen's egg, and this had gradually increased in size The swelling, which at the time of his admission measured about 4 inches in length by 3 in breadth, was situated at about the middle of the upper arm in front, immediately over the biceps muscle, to which it seemed to be adherent It fluctuated readily, and was formed obviously by a sac of some kind containing fluid It had been punctured on the previous day in the surgery by a grooved needle, and a small quantity of thin straw-coloured fluid had escaped There was slight redness of the skin over the swelling, but it nowhere "pointed" like an At this time no complaint was made regarding the shoulder-joint, and nothing regarding its condition was recorded in the notes

(Three years previously the patient had undergone amputation of the thigh on account of "white swelling" of the knee-joint. Beyond this there was nothing apparently worth noting in his previous history, unless that he had had an abscess in each groin about four years ago, and that he had had small-pox)

From the general character of the swelling, and the absence of complaint on the part of the patient of any symptom which might have guided one to a different diagnosis, I came to the conclusion that the tumour must be either a simple cyst or a chronic abscess, and gave directions that it should be again punctured The house-surgeon accordingly punctured it with a tenotomy knife About two ounces of straw-coloured fluid escaped first, then the fluid became blood-stained, and this was followed by the escape of about a dessert-spoonful of curdy lymph or pus.

On examination the fluid was found faintly alkaline, and became solid on boiling Mixed with liq potassae it became slightly gelatinous The pus (?) was slightly soluble in cold liq potassae, and completely so on boiling

(The urine was normal Sp. gr 1025)
Oct 2, 1883—To this date (four days after the puncture) the patient had had no pain in the arm, a good deal of clear fluid had escaped from the site of the puncture

On the following day the patient complained of headache, and his temperature rose to 102°F Pulse 100 In the evening his temperature was 104°F A good deal of purulent fluid escaped from the wound

There Oct 6—The temperature was at this date 102°F

had been less discharge from the wound

At about this time the patient first complained of pain in the shoulder, and I began to suspect the true nature of the swelling of the arm But unless I had previously known that a synovial (p 182) cyst in connection with the knee might appear in the middle of the calf of the leg, it is quite likely that even at this time the direct connection between the abscess and the shoulderjoint would not have been discovered For, as before mentioned, the cyst or abscess was about half way between the shoulder and

the elbow, and my attention had not been previously drawn to

any affection of the former

On questioning the patient, we found now that he had suffered from pain and stiffness about the shoulder-joint for many weeks, although the relation in time between the appearance of these symptoms and that of the cyst in the arm could not be clearly made out

Oct 13—The discharge had now ceased, but there was increased pain in the shoulder-joint, and a slight grating was perceptible on rotating the head of the humerous

Oct 22—At this date it is noted that there is again discharge from the wound in the arm, and that the patient suffers from pain in the shoulder-joint, especially in the evening. He gets up in the afternoon

Nov 5—The patient is now much better. The pain in the shoulder is less, and he can move the arm much better

Nov 11—There is now no pain in the shoulder. The patient can raise his arm The wound still discharges

Nov 26—There is still discharge of pus from the wound, and there is occasionally a good deal of pain in the shoulder-joint, which of late has been swollen and tender

Dec 10—At this date the discharge from the arm had almost ceased, and there was little or no pain or swelling about the shoulder, but during the last few days the patient has suffered from pain in the head and sleeplessness He has also frequently vomited The temperature has varied from 998 to 1016°F.

Dec 11—The patient was delirious this morning, and on the following day he became unconscious, taking no food, and passing his urine and faeces involuntarily.

On December 14 the patient was better, perspiring freely, and quite conscious, but no real improvement was maintained, and he died December 16.

(For the details of the preceding notes I am indebted to Mr. Aldous, surgical dresser)

Post-mortem Examination—Nothing abnormal was discovered in the brain, or in the thoracic, or abdominal viscera

The cartilage had disappeared from the head of the right

humerus and from the glenoid cavity, and pus was found tracking from the joint for some distance backwards beneath the latissimus dorsi muscle.

(p 183) I regret that by some accident no account has been given in the surgical registrar's notes of any careful dissection of the specimen; but there can be no doubt (there was none at the time) that synovial fluid had found its way from the shoulder-joint to the middle of the upper arm by tracking along the course of the long tendon of the biceps muscle

CASE II

Synovial Cyst in connection with the Shoulder-Joint—Puncture— Subsequent Suppuration—Amputation at the Shoulder-Joint— Recovery

In August 1884 I was asked by Dr Fred F Andrews to see, in consultation with him, a patient (F H P), aet 54, with abscess and several sinuses in the upper arm and about the shoulder-joint. He had suffered from aching pains, apparently rheumatic, in the shoulder since November 1883, and in February 1884 there was a large prominent fluctuating swelling at the upper part of the chest, at about the level of the shoulder, but which did not seem to have any connection with the shoulderjoint (although at this time the latter was somewhat stiff and painful), but rather, from its position, to be connected with the anterior and upper part of the thorax In June 1884 the swelling, which was very tense and fluctuated readily, was punctured, when there escaped a quantity of thick yellowish fluid like serum At the time it was considered possible that the fluid, if not cystic, might have come from the thorax, there were no symptoms attracting attention to any definite connection with the shoulder-joint Soon afterwards, however, suppuration occurred in and about the site of the original swelling, and in the neighbourhood of the shoulder-joint. Various abscesses "formed," and were either punctured or burst spontaneously—one above the clavicle, and one or more in the upper arm

The patient, notwithstanding the abscesses and the increasing stiffness of the shoulder-joint, was able to get about, and for a time

to return to his business Suppuration, however, never entirely ceased, and indications of disease of the shoulder-joint became more and more marked

When I first saw the patient, he was in the condition just mentioned, able to get about, but with several sinuses leading for long distances beneath the skin and towards the shoulder-joint, with pus escaping rather profusely from some of them (p 184) The joint was stiff, but at this time no symptoms of acute disease were present

Some few months afterwards, in December 1884, the symptoms, both general and local, became much more serious. There could be no doubt that the shoulder was undergoing a process of acute inflammation and disorganisation, abscesses were extending from it in various directions, with profuse discharge from sinuses above the clavicle and in front of the shoulder and in the upper arm. The patient's health was much broken, he had a red, glazed, and aphthous tongue, and a hectic temperature, and was fast losing flesh and strength

I performed amputation at the shoulder-joint in December 1884, the patient afterwards making a rapid and complete recovery

The specimen, which was kindly dissected for me by Mr. D'Arcy Power, curator of the Museum at St. Bartholomew's Hospital, is figured in the 36th volume of the Path Soc Trans, plate xii, p 336. It shows the effects of acute inflammation of the head of the humerus, with ulceration and destruction of the cartilage. In connection with it are the remains of a cyst, which was probably in connection with the bursa beneath the subscapularis muscle.

CASE III

Synovial Cyst in connection with the Elbow-Joint

A post-office porter (W H), aet 32, was admitted into St Bartholomew's Hospital, under my care, in August 1884, on account of a swelling in the neighbourhood of the left elbow-joint

The swelling, which had an oval outline, was about the size of a hen's egg, and was situated immediately above the internal condyle

The skin over it was quite normal, and was not adherent to the tumour. There was slight fulness on each side of the triceps tendon, just above the olecranon, as if from the presence of fluid in the elbow-joint. The movements at the elbow-joint were painless, but the forearm could not be quite completely flexed or extended. The swelling was not tender, but a little pain was produced by free movements at the joint.

The swelling was first noticed two years and a half ago, when it was about the size of a small nut. It grew slowly, but for the

last three or four weeks has rather rapidly increased.

A few days after the patient's admission into the hospital, the swelling was tapped, when some brownish viscid synovial fluid containing granular matter escaped

(p 185) The tumour almost entirely disappeared after the tapping, but rapidly re-filled, and the patient left the hospital in almost exactly the same condition as on admission.

I have seen the patient at intervals of a few weeks to the

present time (November 1885)

But little alteration has occurred in the swelling, but gradually, under gentle pressure with a flannel bandage, the size has somewhat diminished, and the patient has been able to do his work, the pain and tenderness gradually becoming less, and the movements of the arm less restricted

CASE IV

Synovial Cyst in connection with the Elbow-Joint

(For permission to publish this case I am indebted to Mr. Savory, and for the notes to his house-surgeon, Mr Lawrence)
A man (H D), aet 40, was admitted into St Bartholomew's Hospital, November 25, 1884, under the care of Mr Savory, on account of a swelling in the arm The swelling is situated on the inner side of the left elbow, about an inch above the internal condyle, being somewhat larger than a pigeon's egg, fixed to the deeper textures, but, like the skin over it, freely moveable There is fluctuation The arm cannot be extended beyond an angle of 120°, and cannot be completely flexed

The swelling was first noticed in the beginning of May last,

and increased so rapidly that the patient came to the hospital as an out-patient about a week afterwards. At that time the swelling extended in front from the internal to the external condyle; full extension being impossible

An angular splint was applied, with lotio plumbi dressing. After about six weeks the arm had so much improved that in July the patient recommenced work, but about a week before his admission he again suffered from pain and swelling and inability to fully extend the arm.

A few days after his admission into the hospital the tumour was punctured with a grooved needle, and about three drachms of thin glairy and curdy, apparently synovial, fluid escaped A pad and bandage were applied and the arm placed in a sling.

As a result of the treatment the swelling almost disappeared, but in a few days it "re-formed," though it did not become so large or tense

January 10, 1885—Another small incision into the tumour was made today, when some clear yellow glairy fluid escaped, with a small piece of what looked like thickened synovial (p. 186) membrane A pad was applied, and a few days afterwards the patient left the hospital wearing a plaster of Paris bandage.

I have seen one other case very like the two which have been just recorded

CASE V

Synovial Cyst in connection with the Hip-Joint

(I am indebted to Mr Thomas Smith for an opportunity of seeing on several occasions the patient to whom the following account belongs, which has been published by Mr. Stephen Paget in the 36th volume of the Trans Path Soc of London p. 242)

in the 36th volume of the Trans Path Soc. of London, p 342)
"William B, house-decorator, aet 34 Father rheumatic,
himself healthy, except for rheumatism Four children, all
very healthy, has lost none

The history of his case is as follows:-

In 1874 he began to feel pain in the left hip and knee

In 1876 these pains interfered with his work He was in St.

George's Hospital for four months, and then in the Royal Free Hospital

In 1877 he was in St. Bartholomew's Hospital under Mr. Thomas Smith The left hip was immoveable; the left knee was stiff, there was slight fulness below Poupart's ligament, and the note taken at this time puts "deep-seated fluctuation (?)." He was treated by extension of the limb with a weight of 10 lbs., and was sent out on crutches

In 1883 he was again admitted, having managed to get about and do his work for the last six years. The movement of the left knee was now much impaired, and of the left hip still more. There was pain only after exertion. The limb was everted and three-quarters of an inch shortened. The trochanter was thickened. The whole of Scarpa's triangle, from Poupart's ligament to the middle of the thigh, and inward as far as the edge of the adductor longus, was occupied by a large hemispherical cyst, fluctuating throughout, measuring $7\frac{1}{2}$ inches vertically by 7 across. It was tapped, and 42 oz. of yellow alkaline fluid drawn off, of specific gravity 1028, containing much fat and cholesterine. Next month it was again tapped.

In 1884 it was again tapped, and 40 oz. of fluid, evidently

synovial, were drawn off.

In 1885 (March) he can get about well enough to do his work, and can walk two miles He has lately suffered from more pain. There are pain and creaking noises in both shoulders. He complains (p 187) of pain at the back of the head and at the epigastrium Pupils normal; patellar reflex normal. The cyst is filling again. The veins of the limb are varicose. There is no oedema of the scrotum, such as followed the first tapping in 1883."

The following case of disease of the ankle-joint appears to be one of like nature to those previously recorded. But I do not remember seeing the case, and lighted upon it only by accident in the Hospital Records

CASE VI

Synovial Cyst over and below the External Malleolus

"E B, aet 13, was admitted into Darker Ward, March 22, 1879, under the care of Mr. Callender.

No history of injury

In the last three years patient has noticed a swelling in the neighbourhood of the left ankle-joint, which has varied in size, nearly disappearing after prolonged rest, and getting much larger during exertion. It gives him no pain, but he states that the joint is weak, and inclined to yield under him

24th—At present there is a small, smooth, fluctuating swelling stretching along the anterior edge of the external malleolus, generally rounded in shape, and evidently containing fluid. The skin over it is natural, with the exception of having been discoloured by the application of some iodine. The top of the swelling slightly overlaps the surface of the malleolus, but does not extend either below its apex or under the anterior tendons. No alteration in size is noticed after short pressure upon it. The hollow behind the malleolus, between it and the tendo-Achillis, is not so well marked as it should be. The anterior tendons are rather more lifted up from their bed than those of the opposite side. There is no thickening of the bones round the joint, nor is there any pain on movement or pressure anywhere. Mobility (passive) of the joint appears, if anything, to be increased

25th—Trocar and cannula inserted into swelling, with the result of evacuating a clear, gelatinous, synovial fluid

April 4 —The swelling has again increased

- 9—Swelling tapped, and lead foil strapped over the part where the fluid had been evacuated
- ²⁹—Swelling much smaller than formerly, but still it gives a sense of fluctuation

May 23 —Swelling nearly gone.

(p 188) Discharged

Readmitted into Abernethy Ward under the care of Mr Savory, January 1, 1880

In the last five months he has been in Bow Infirmary, and unable to walk

He cannot now bear his weight upon his left foot. The foot he keeps extended, and cannot flex it more than to a right angle. The leg and thigh have wasted, and are conspicuously smaller than the right. There is uniform swelling round the ankle-joint. It is soft and tender on pressure.

The surface of the joint is hot, and when the foot is moved or the heel pressed upwards he complains of pain

Back splint, swing cradle, lotio plumbi

Jan 8 -Ol morrhuae, syr. feri phos 1 ter s.

18.—Less tenderness

26 -Gum and chalk bandage

Discharged.

I have seen a case some few years since of an apparently bursal multilocular cyst on the back of the fore-arm and carpus, which I have no doubt was identical in its pathology with that of the synovial cysts here described. Unfortunately I cannot find any written notes of the case The patient was a man about 30 to 40 years of age, a butcher from Smithfield Market, who attended as an out-patient for many months on account of a large fluctuating irregular swelling on the back of the hand and extending up the fore-arm for some little distance, the swelling being deepseated and involving the region of the sheaths of the tendons, but without any indications of being produced by a regular thecal distension On the contrary, the swelling was irregular in outline, as if more or less multilocular, with a general thickening of all the tissues in the neighbourhood of the wrist-joint, and I believe (although I cannot now speak positively on this point) with restricted movement of the latter

With the help of elastic support to the wrist the patient was able to continue his work, and although the question of operation was often considered, I never felt justified in recommending any After many months I lost sight of the case, but the last memory I have of it is distinctly that of a more or less thickened and crippled wrist-joint, and not that of thecal disease only.

In the British Medical Journal, vol 11 1884, p 413, Mr Arthur

T Norton describes cases of what he terms "gangliar disease of joints," which seem to me identical with the case just described, and which, like it, are probably identical in their pathology (p. 189) with many of the cases which I have related in connection with other joints

"In one case a woman, aet. 40, fancied she had sprained her wrist five years ago, but did not recollect the occasion. For four years there had been some swelling and pain, but she had not been prevented from continuing her employment as a domestic servant. For the last three months before admission to the hospital there was a so-called ganglion about four inches in length, extending upwards from the wrist-joint in the centre of the forearm. The ligaments of the wrist-joint were sufficiently loose to allow lateral gliding movement. The annular ligament was pushed forward by ganglionic enlargement, and there was evidently fluid within the wrist-joint. The hand hung down, and there was no power to raise it. The hand was quite useless, and the disease was increasing and had continued so to do for more than five years, regardless of treatment."

From a past experience of similar cases Mr Norton concluded that the only treatment was amputation, which he accordingly performed On examination of the hand after removal, he found the ganglion already mentioned filled with the usual jelly-like material, which on pressure separated into plates or melon-seed shapes. This ganglion extended into the wrist-joint. The wrist-joint contained a small quantity of fluid, the synovial membrane was villous, the ligaments were distended and allowed lateral gliding movement of the joint, and all the bones of the carpus were rarefied or softened, so that a pin or a knife could be easily pushed through their substance. Though there was no caries, the articular cartilages were thinned

Mr Norton relates other similar cases

From the foregoing cases the following conclusions may be drawn —

I That abnormal synovial cysts may be formed in connection, not only with the knee, but in connection with the shoulder, the elbow, the wrist, the hip, and the ankle joints

- 2 That the manner of formation of these synovial cysts probably resembles that which has been proved to occur in connection with the knee-joint, namely, that the synovial fluid on reaching a certain amount of tension by accumulation within the joint, finds its way out in the direction of least resistance, either by the channel by which some normal bursa communicates with the joint, or, in the absence of any such channel, by forming first a hernia of the synovial membrane. In both cases, should the tension continue or increase, the fluid at length escapes from the sac, and its boundaries are then formed only by the (p 190) muscles and other tissues between and amongst which it accumulates
- 3 That in the case of the shoulder-joint the abnormal synovial cyst may be found either in front a little below the clavicle, or in the upper arm in the region of the biceps muscle
- 4 That in connection with the elbow-joint the cyst is usually placed on the inner side, a little above the internal condyle of the humerus
- 5. That in the case of the wrist-joint the synovial cyst may be either in front or behind
- 6 In the only case in connection with the hip of which a note has been preserved, the swelling was in the upper part of Scarpa's triangle
- 7 In the one case in connection with the ankle-joint the synovial cyst was in front and to the outer side
- 8 That the apparent want of direct communication between the joint and the abnormal synovial cyst is frequently deceptive, and should not lead to the inference that no such communication exists
- 9 That the caution given in the previous communication, not to interfere by operation with these synovial sacs without good reason, has been justified by increased experience

Hitherto I have not discovered any relationship between the form of osteo-arthritis with which some of these synovial cysts are associated and locomotor ataxy, but I suspect that in some of them a relationship will be found to exist

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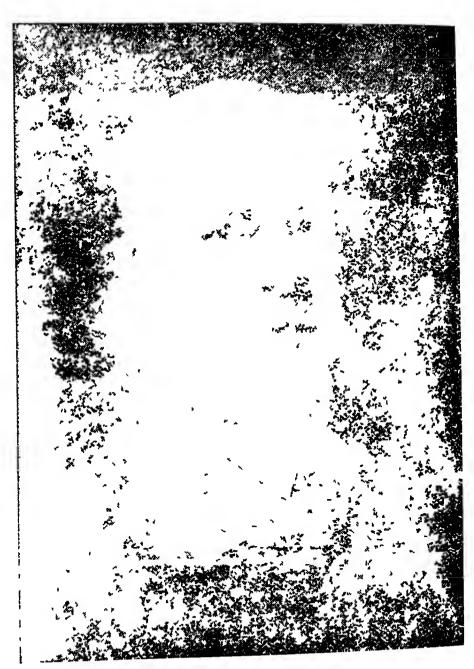
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WILLIAM HENRY WELCH

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William Henry Welch

BIOGRAPHY

- 1850 Born April 8, in Norfolk, Conn, the son of Dr. William Wickham Welch and Emeline Collin Four uncles were doctors
- 1866 Age 16. Entered Yale University.
- 1870 Age 20 Received the A.B. degree from Yale.
- 1871 Age 21. Spent a year teaching Greek and Latin in Norwich, N Y Entered The College of Physicians and Surgeons, New York City, but interrupted his medical course to take special chemical training at Yale
- 1874 Age 24. Became interne at Bellevue Hospital and assistant to the professor of anatomy.
- 1875 Age 25 Received the M.D degree from the College of Physicians and Surgeons
- 1876 Age 26 Went to Europe Studied in Strasbourg under Waldeyer, Hoppe-Seyler and von Recklinghausen, in Breslau under Cohnheim, in Vienna under Chiari, Meynert and Hebra, and in Leipzig, Paris and London.
- 1878 Age 28 Returned to the United States
- 1879 Age 29 Made professor of pathologic anatomy and general pathology in Bellevue Hospital Medical College,
 New York City Held this position until 1884
- Age 34 Professor of pathology in Johns Hopkins University, Baltimore, until 1916. Made his second trip abroad, studied under Koch and Flugge until 1885
- 1889 Age 39 Pathologist of Johns Hopkins Hospital, at its opening

- 1891 Age 41. President of the Medical and Chirurgical Faculty of Maryland.
- 1893 Age 43. Dean of the medical faculty of Johns Hopkins University, until 1898
- 1894 Age 44. Given honorary degree of M D. by the University of Pennsylvania, and the degree of LL D by the Western Reserve University, Cleveland
- 1896 Age 46 Given the degree of LL D. by Yale University.
- 1897 'Age 47. President of the Congress of American Physicians and Surgeons.
- 1898 Age 48. President of the Maryland State Board of Health, until 1922, and continued as a member until 1929.
- 1900 Age 50. Given the degree of LLD by Harvard University
- 1901 Age 51. President of the board of directors of the Rockefeller Institute for Medical Research until 1933. President of the Association of American Physicians
- 1902 Age 52 Huxley lecturer in the Charing Cross Medical School, London
- 1903 Age 53 Member of the board of trustees of the American Medical Association, until 1909 Given the degree of LLD by the University of Toronto
- 1904 Age 54 Given the degree of LL D. by Columbia University.
- of the American Association for the Advancement of Science, and again in 1907
- 1907 Age 57 Given the degree of LL D by Jefferson Medical College
- 1910 Age 60 President of the American Medical Association and of the National Tuberculosis Association
- 1913 Age 63. President of the National Academy of Sciences, until 1916
- 1915 Age 65 Given degree of LLD by Washington University
- 1916 Age 66 Given degree of LL D by University of Chicago.

 Director of the School of Hygiene and Public Health,

until 1926. President of the American Social Hygiene Association, until 1919.

1917 Age 67. Commissioned Major in the Medical Reserve Corps

1918 Age 68. Advanced to Lieutenant Colonel.

1921 Age 71 Made Brigadier General in the Officers Reserve Corps, serving principally as adviser in the Surgeon General's Office.

1923 Age 73. Given degree of DS by Cambridge University and the doctorate of the University of Strasbourg.

1926 Age 76. Professor of the history of medicine at Johns Hopkins

1929 Age 79 Given degree of DS. by the Western Reserve University.

1930 Age 80 Given degree of LL.D. by the University of Southern California and by the University of the State of New York. Given the degree of D.S by the University of Pennsylvania

1931 Age 81. Became emeritus professor of the history of medicine at Johns Hopkins.

1934 Age 84. Died April 30 in Johns Hopkins Hospital, Baltimore.

He served as a member of the International Health Board and of the China Medical Board of the Rockefeller Foundation and was frequently consulted by the League of Nations. He was President of the National Committee of Mental Hygiene Distinguished medical and sanitary organizations in England, Scotland, Ireland, Austria, Germany, Belgium, France, Italy and Switzerland bestowed honorary memberships upon him. Japan, Norway, Servia, France, as well as the United States Government honored him with decorations.

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INTRODUCTION

This number of Medical Classics is devoted to one of the great leaders of American medicine, William Henry Welch — A native of Norfolk, Connecticut, educated in the best schools of America and Europe, Dr Welch became professor of pathology at Johns Hopkins University at the age of thirty-four. With that institution he was intimately connected for the next fifty years — He influenced with methods of hard work and logical thinking a long line of students who have been and are now the leading doctors of America

As early as 1877, while a student of Cohnheim in Germany, Dr Welch performed some important investigative work on acute edema of the lungs; the publication of this study was the start of an extensive list of more than four hundred contributions to medical science. Among his most important works are his discovery of the Staphylococcus epidermidis and its relation to wound infection, his work on the Bacillus aerogenes capsulatus or gas bacillus, and a book on embolism and thrombosis. He made valuable contributions to the knowledge of diphtheria at the same time von Behring was doing the work which won for him the first Nobel Prize.

Dr. Welch had found in medical literature the account of "many cases in which the blood-vessels after death contained air or gas which did not seem attributable to post-mortem decomposition." When such a case came to his attention, he put to work all his knowledge of bacteriology and pathology and soon had isolated a new germ as the cause of the disease. This germ he named, after considering its characteristics of shape and behavior, the Bacillus aerogenes capsulatus. By this name it is still generally known although the nomenclature committee of the Society of American Bacteriologists has decreed that the name should be, because of its spore forming properties, Clostridium welchii

The Clostridium welchii is the common cause of gas gangrene which was so prevalent in World War I and is still met with frequently in civil life after serious accidents, especially those with the automobile. The organism is present in the intestinal tract of man and animals and because it forms spores (an inactive phase), it is able to live for long periods in the soil. When a deep wound is contaminated with dirt, especially if muscle is devitalized, and there is lack of air in the deep tissue spaces, the Clostridium welchii finds an ideal place for growth. A powerful exotoxin is produced. The patient becomes extremely ill, the infection extends rapidly and death comes within a very few days.

Fortunately for soldiers and civilians today, we have means of combating this infection. Following the pioneer work of Dr. Welch in isolating the organism, a specific antitoxin has been

prepared Wounds which are deep and contaminated with dirt should be thoroughly debrided. Many doctors give the gas bacillus antitoxin routinely in such cases, while others use it whenever the indication arises. Amputation is frequently necessary. But the death rate has been markedly reduced and the person responsible for starting this improvement is the subject of this number, Dr. William Henry Welch.

No better summary of Dr Welch's life can be given than the following which was part of his obituary which appeared in the Journal of the American Medical Association, 102. 1513-1514,

May 5, 1934

"The influence of Dr Welch on American medical education during the last twenty years is impossible to overestimate tainly, he played an important part in the development of the full time system of teaching in the clinical branches, in the establishment of schools of public health and hygiene, and in stimulating great financial contributions for the advancement of preventive medicine and public health So significant was this influence that even during the last five years of his life, when he was ill much of the time, his very spirit dominated the minds of many of those who had been associated with him No doubt, much of his great influence was due to the remarkable geniality of his character. His personality was sparkling, his wit noted, and the twinkle of his eye characteristic. His friendships were abiding and he gave freely of himself to almost every demand that came upon him His culture was notable and his familiarity with the literature, music and art of his time equal to that of many experts in all of these fields Such men do not come often in any phase of human life, but when they do appear the humanistic quality of their greatness brings them universal recognition"

Thus this final number of MEDICAL CLASSICS is devoted to a great American medical leader whose work has been responsible

for the saving of countless lives and limbs



A Gas-producing Bacillus (Bacillus Aerogenes Capsulatus, Nov. Spec.) Capable of Rapid Development in the Blood-vessels after Death

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HERE are to be found in medical literature many cases in which the blood-vessels after death contained air or gas which did not seem attributable to post-mortem decomposition. Various explanations of this occurrence have been offered. The observation to be here re-

ported is calculated to shed light upon some of these mysterious cases. The micro-organism to be described is in itself also of much interest

The following is an abstract of the clinical history and postmortem examination of the case

J. M., male, light mulatto, aged 38, bricklayer. Admitted to the hospital, service of Dr. Osler, Oct. 24, 1890, discharged

July 15, 1891, readmitted Oct. 24, 1891, died Oct. 25, 1891. Patient has used alcohol to excess and gives a history of syphilis. For two years has suffered from pain in the chest, dyspnoea, and paroxysmal cough Spat blood three years ago Six weeks before admission first noticed a pulsating lump on the right side of the chest Upon admission there is observed a large, hemispherical, pulsating tumor in the right infraclavicular and mammary regions, reaching the border of the sternum, and most prominent in the second intercostal space. The skin over the tumor is intact and brownish in color The manubrium sterni near the second costal cartilage is eroded. Percussion note over tumor is dull Apex beat of heart in 5th interspace No cardiac Cardiac dulness not increased No tracheal tugging Arteries stiff, tension increased, pulse 84 No difference between Pulmonary râles heard in scapular regions While in the hospital the tumor gradually increased in size, extending from the sterno-clavicular articulation to the nipple, with complete erosion of sternum over about one-half its width Thoracic and epigastric veins distended. Urine free from albumen and casts Patient left the hospital in July, 1891 When readmitted on October 24th, 1891, he reports that his condition remained about the same until a month ago, when a small ulcerated opening formed over the tumor, through which he lost about a pint of blood. A week later a larger rupture occurred on coughing, and he says that he lost about a gallon of blood, some coming through the mouth. A third hemorrhage occurred the night before readmission, when the blood spurted through both external openings, to the extent, he says, of about a gallon Upon readmission the patient's condition did not appear to be immediately alarming His mind was clear, appetite good, and there was no dys-The urine contained a small quantity of albumen with hyaline and granular casts The patient died suddenly, without any further loss of blood, at 6 o'clock A M, October 25th. In view of what was found at the autopsy, it may here be stated that no emphysematous swelling of the neck and no escape of gas from the ruptured openings of the aneurism were observed during the short time the patient lived after his re-entrance to the hospital,

or immediately after his death, but no special attention was directed to these points.

The post-morten examination was held eight hours after death, the (p. 82) weather being cool. The body was still warm and presented no discoloration of the skin of the abdomen or other signs of decomposition.

Rigor mortis present. Considerable emaciation. Puffiness of lower eyelids Diffuse livid redness of face. Lower portion of neck up to the upper level of thyroid cartilage diffusely and symmetrically swollen, with emphysematous crackling, extending on the right side posteriorly to the vertebrae, on the left most evident anteriorly and laterally. Emphysematous crackling can be felt also in both axillae, on the inner side of the arms, over the pectoral muscles, over the buttocks, in the groins and the inner side of the thighs. The subcutaneous veins over the abdomen and thorax, especially on the right side, are distended, tortuous, and contain gas-bubbles. Emphysematous crackling can be felt along the track of the superficial veins and over most of the body and extremities, it is limited to them.

Anteriorly on the right side of thorax is a tumor, with fluctuating feel, projecting about 4 cm. above the level of the skin, and extending from the first rib downward a distance of 12 cm., and and laterally from the right margin of the sternum 11 cm, the most prominent part being 4 cm. from the sternal border. Near the most prominent part of the surface of the tumor are two circular openings through the skin, 1 cm. and 0.5 cm. in diameter, from which thin bloody fluid, mixed with gas-bubbles, escapes.

Before making the usual incisions into the abdomen and thorax, a number of veins and arteries, including the jugular, femoral and brachial veins, superficial veins of abdominal wall, femoral and temporal arteries, are carefully exposed by small suitable incisions through the skin covering them, and the presence of gas-bubbles is determined in all of them without opening them. The presence of gas in the subcutaneous connective tissue of the neck is also determined by incision. The gas burns with a pale bluish, almost colorless flame, a slight explosive sound being heard at the moment of ignition.

Peritoneal cavity dry and not distended with gas Visceral and parietal peritoneum, including omentum, studded with small, gray, translucent, firm nodules (miliary tubercles), averaging 0.5 to 1 mm in diameter Old fibrous adhesions around the spleen and between liver and diaphragm Diaphragm on right side at 5th, on left at 6th rib

Pleural cavities completely obliterated by old adhesions. Pericardial sac contains 30 cc thin, blood-stained serum containing gas-bubbles. Dimensions of heart normal, save slight hypertrophy of right ventricle Cardiac veins and arteries are full of gas Right ventricle and auricle contain soft, dark-red coagula and thin, lac-colored blood, with which are mingled gasbubbles in large number. The left cavities of the heart contain similar material in smaller quantity, together with gas-bubbles Pulmonary artery and veins contain gas-bubbles The muscular wall of the heart is soft and flabby and presents a peculiar spotted appearance on section. There are numerous small cavities, about 05 to 1 mm. in diameter, containing gas throughout the myocardium Immediately around these cavities the muscular tissue has a pale whitish appearance. Cardiac valves normal, except a few whitish atheromatous patches on the left aortic segment of the mitral valve. Thickness of wall of left ventricle 16 mm, of right ventricle 5 mm, length of ventricular cavity 75 cm, inner circumference of aorta just above valve 8 cm. Endocardium diffusely blood-stained

Ascending arch of aorta much dilated, wall thickened, inner surface diffusely blood-stained and presenting many firm, partly calcified atheromatous patches 5 cm. above the aortic valves, just above the duplicature of the pericardium, is a nearly circular opening 3.5 cm in diameter, with sharply circumscribed, smooth, rounded edges in the anterior and the right wall of the aorta. This opening, which is 25 cm below the origin of the innominate artery, leads into a large aneurismal sac, which has developed chiefly forwards and to the right and produced the tumor visible externally. The aneurism measures 12 cm in vertical and transverse diameters, and 75 cm. in antero-posterior diameter. It extends from the upper margin of the clavicle to

the 4th rib. Its median border corresponds to the mid-line of the sternum. The eroded surfaces of the first, second and third ribs and of the sternum form a part of the anterior wall of the aneurism. The second rib has been completely destroyed at a point 3 cm. from the border of the sternum. The aneurismal sac is in relation above with the subclavian vein and innominate artery and vein, below with the pericardium, to the right with the upper lobe of the right lung, to which it is firmly adherent, and on the median side with the thickened tissues of the anterior mediastinum. There are no evidences of pressure upon the oesophagus, trachea, or main bronchi. The walls of the aneurism are intact, except at the two openings in the skin already described. The sac of the aneurism is completely filled with coagula, those nearest the mouth being soft, dark-red post-mortem clots, the rest, which nearly fill the cavity, are laminated gray and reddish firm antemortem coagula, which can be removed with the fingers without much difficulty, except those nearest the wall, which are firmly adherent. The laminated coagula present pale white streaks and dots and contain many gas-bubbles.

Lungs, hyperaemic, oedematous, pigmented with coal, in upper lobes old cavities with fibrous wall and caseous contents, dense interlacing fibrous tissue, a few caseous nodules, and throughout both lungs many small, firm, gray miliary tubercles, without fresh pneumonia Bronchi contain muco-pus, their inner surface diffusely reddened

Spleen, dimensions 13 x 8 x 4 cm Studded on its surface with miliary tubercles, with a few grayish tubercles in parenchyma, which is soft, brownish red, and on pressure permits a large number of gas-bubbles to escape Malpighian bodies indistinct. Kidneys, dimensions normal, capsule not adherent, surface

Kidneys, dimensions normal, capsule not adherent, surface smooth, thickness of cortex 8 mm. Markings coarse, color pale, a few small, grayish-yellow tubercles visible on the surface and on section. Gas-bubbles escape on section and by pressure from the renal blood-vessels. The tissues in the pelvis of kidneys are diffusely red, from imbibition of blood coloring matter.

In lower third of ileum are several scattered fresh tubercular ulcers, nearly circular in shape, not extending deeper than

submucosa. Mesenteric glands pale, swollen, contain a few tubercles.

Stomach and duodenum contain much mucus Dark, brownish-yellow bile can be readily squeezed from gall-bladder through common bile-duct.

Liver, dimensions 29 x 19 x 7 cm, presents emphysematous crackling on pressure Surface and cut section present a peculiar mottled appearance, from the presence of many little, round, gas-containing cavities, about 1 to 2 mm in diameter, which appear transparent as seen through the capsule. Walls of cavities appear smooth and formed by pale whitish liver substance Hepatic parenchyma soft, pale and brownish in color. Gas-bubbles in large number in the vessels of the liver.

Urinary bladder contains 50 cc clear urine Flat, depressed scar on glans penis in place of frenum Old scars in groins

Aorta very atheromatous throughout its course Large and small arteries present scattered patches of atheroma. The intima of all the large arteries and veins is diffusely red, from imbibition of blood coloring matter. The blood is thin, watery, transparent and lac-colored, and everywhere contains gas-bubbles. The gas-bubbles are both large and small. No distinct odor can be detected from the blood, and in general there are no putrefactive odor and no greenish discoloration about the body.

Microscopical examination of fresh blood and organs—The blood, taken with care from the interior of veins and arteries immediately after opening them, shows fewer and paler red blood corpuscles than normal. Many of the red corpuscles are irregular in shape, and there are shadows of corpuscles There has evidently been a solution of some of the coloring matter of the red corpuscles. The leucocytes are swollen and their granules often in molecular movement

(p 83) The blood from the heart and vessels is rich in bacilli, about 3 to 5 μ , in length, about the thickness of anthrax bacilli, with ends slightly rounded, sometimes almost square-cut, occurring chiefly in pairs and in irregular masses and not in long chains. The same bacilli are present also in very large number in cover-slip preparations from the laminated clot of the aneurism,

the liver, the spleen and the kidney. In all of these situations the bacilli appear to be in pure culture, no other species being observed. The bacilli are not motile. They stain readily with the usual aniline dyes, but often present small unstained spots. They possess a capsule, evident on the stained specimens.

Frozen sections of the fresh liver show the small cavities, visible to the naked eye, to be surrounded by liver cells, much disintegrated and fatty degenerated. Here the hepatic cells lie loose, with an indefinite granular deteritus between them, whereas elsewhere the rows of liver cells, which also contain large and small oil globules, are preserved Bacilli are present throughout the liver, but are by far most abundant in and near the small cavities. Several fresh miliary tubercles are seen in the sections

Sections of the frozen fresh myocardium show also little cavities with many bacilli and disintegrating muscular fibers containing fine fatty granules in their walls Elsewhere the muscular fibers show good striation, with a few scattered small oil globules. There appear to be more fatty granules in the broken-up fibers near the cavities than elsewhere.

Sections of the fresh kidney show with a low power areas darker and more opaque than the rest of the tissue and corresponding to groups of perhaps a dozen cortical tubules. In these areas the epithelial cells are finely fatty and desquamated, and here there are many bacilli, whereas elsewhere the epithelium does not appear much altered and bacilli are less numerous. A few small gascontaining cavities are present in the cortical substance. There are some atrophied glomeruli with thickened capsules, foci of increased intertubular tissue, thickened arteries, and many waxy casts in Henle's tubules.

Microscopical examination of hardened organs—Small pieces of the organs were hardened in alcohol—Sections of these confirm the observations made on the fresh tissues—The liver shows many miliary tubercles with giant cells—These tubercles tend to become hepatic cells—There is a new growth of fibrous tissue in the external capsule of the liver.—The interlobular connective tissue is moderately thickened, chiefly in irregular nodules and

areas in connection with the tubercles The kidney is the seat of chronic diffuse nephritis in moderate degree

In the sections the bacilli stain readily with all of the ordinary aniline dyes (methylene-blue, gentian-violet, fuchsine) and stain well even with hematoxylin. They stain excellently by Gram's method, retaining the color after the nuclei have been decolorized. Their length averages one-half to two-thirds the diameter of the red blood corpuscles seen on the same sections, and their thickness is perhaps a little greater than that of anthrax bacilli, from which they are especially distinguished by not occurring in long chains

The bacilli are found abundantly in the large arteries and veins throughout the lumen, but seem to be more numerous in the veins Some sections of vessels, particularly of arteries, are free from the bacilli. Although some capillary blood-vessels are plugged full of bacilli or contain them in large number, most of the capillaries in the different organs do not contain them. The nuclei in the walls of the vessels containing bacilli, even those of the endothelium, stain well as a rule, but sometimes the nuclei do not stain. Occasionally the bacilli are found not only in the lumen but also in the walls of the vessels, and they occur in scattered spots in the tissues. The lymphatics in the pericardium are beautifully injected with masses of bacilli.

When the bacilli are accumulated in large masses in the tissues the surrounding nuclei usually do not stain. The bacillar masses can be seen with the naked eye on stained specimens as deeply stained dots, and occur scattered irregularly. The zone of unstained nuclei around the clumps of bacilli in the tissues is wider in the liver than in the kidney, and wider in the kidney than in the heart muscle. Elsewhere the nuclei stain well. The absence of nuclear staining must be due to the products of the growth of the bacilli, for it occurs at a considerable distance, for instance the thickness of a lobule in the liver, from the spot where the bacilli are present. There is no nuclear fragmentation. The nuclei either cannot be made out at all or appear as very pale bodies. In the heart muscle near the masses of bacilli in the tissue the nuclei seem smaller than elsewhere, whereas in the

liver there are many nuclei swollen to three or four times their normal size, appearing as empty cavities with a stained rim, suggesting somewhat drops of fat, from which, however, they can be readily distinguished by the sharp stained ring around them and the transitions to the normal nuclei. These peculiarly altered nuclei can be seen scattered irregularly through the liver as well as in or near the areas with unstained nuclei. There is absolutely no evidence of reaction in the tissues around these areas or the masses of bacilli

The cavities which were visible to the naked eye and on frozen sections as gas-blebs appear on the hardened sections in size and shape. The smaller ones are regularly round, often with smooth walls Larger ones, which may be I to 2 mm in diameter, may be oval or irregular in shape, and evidently may be formed by the coalescence of smaller cavities. are in almost or quite continuous mass in the margin of these cavities, and for a variable distance around them the nuclei do not stain There is evidence of pressure upon the tissues around the cavities. Areas can be seen in which dense masses of bacilli lie between the broken-up loose tissue elements (liver cells, muscle-fibers) without stained nuclei. In spots in the liver the intralobular capillaries are plugged with bacilli. Exceptionally, bacilli are present in the lumen of urinary tubules They are generally absent from the intertubular and glomerular capillaries, and are more abundant in the cortex than in the pyramids. The bacilli are much more numerous in the hepatic and portal veins than in the hepatic arteries

Cultures in nutrient agar-agar were made from the heart's blood, the aneurismal clots, the liver, spleen and kidney. These cultures were made according to our usual custom in the progress of the autopsy. The surface of each organ as soon as exposed is thoroughly burnt over a sufficient area by a flat piece of metal heated to redness, and Nuttall's thick platinum needle¹ thrust into the interior through the burnt area. As it seemed probable that the bacilli found on the cover-slips would prove to be anaerobic, in addition to the ordinary roll cultures, tubes one-

¹ Nuttall Centralblatt f Bakteriologie, 1892, Bd XI, No 17, p 538

half or three-quarters filled with liquefied agar at 40° C were inoculated with material from the platinum loop, and after thorough mixing the agar was allowed to solidify in the upright tubes. The tubes were placed in the thermostat at 37° C

After 24 hours no growth appeared in any of the roll cultures and none subsequently developed. On the other hand the tubes of high agar showed an abundant growth in the form of small, grayish-white colonies, with many gas-bubbles, in the lower two-thirds of the agar, but no growth in the upper third. The organism in the cultures is therefore anaerobic and incapable of development in plain agar in the presence of much free oxygen. Microscopical examination of the cultures showed only one species, and that a bacillus identical morphologically with that found in the cover-slip preparations of the (p. 84) fresh blood and organs. The cultures from the blood and all of the organs mentioned presented the same appearance and were pure of this same bacillus. From single colonies other tubes of high agar were moculated, and thus the organism was obtained in pure culture for further study, the results of which will now be presented

Morphology—The usual form of the bacillus is straight, but sometimes in fresh cultures, more frequently in old ones, slightly curved or bent forms are seen. The ends of the bacillus are slightly rounded, or they may appear, especially the adjacent ends in pairs or short chains, as nearly or quite square-cut, but this latter appearance is not so uniform and outspoken as with the anthrax bacilli

The bacillus varies somewhat in size, especially in length, in different culture media. It appears usually thicker and more variable in length in artificial cultures than in the blood of animals or of man. The average thickness in fresh cultures is a little greater than that of the anthrax bacillus. The average length in fresh cultures may be placed as 3 to 6 μ , but forms are common in the same culture which are shorter, as well as those which are two to three times longer

The bacilli occur singly, in pairs, in clumps, and sometimes in short chains When placed end to end the rods may be in a straight line, but they are often at an angle with each other

Long chains and long threads have been seen exceptionally both in the blood of animals and in cultures, but the absence of a tendency to grow in long chains is a distinguishing point between these bacilli and those of anthrax.

The bacillus is not motile. This point has been tested repeatedly both in the blood of animals and in fresh bouillon and agar cultures.

As has already been mentioned for the sections, the bacilli stain readily with ordinary aniline dyes. With Gram's method the dried and heated cover-glass preparations do not retain the dye so persistently as do the sections of alcohol-hardened specimens. With methylene-blue the rods from fresh cultures stain uniformly, or they may show little unstained dots irregularly placed and occasionally so numerous as to give a granular or vacuolated appearance to the rods. Less frequently are also seen in some bacilli specks more deeply stained than the rest of the rod.

Capsules can often be demonstrated around the bacilli, but they do not seem to be constantly present. They make one of the most important morphological features of the bacillus have been found both in cultures and in the animal body. They appear as clear zones when unstained. We have found the following method well adapted for bringing to view the capsules, which, however, may appear by ordinary methods of staining. The dried and not overheated cover-slip preparations are treated first with glacial acetic acid, which is allowed to drain off and is at once replaced by a strong aqueous solution of gentian-violet, which is to be added several times until it has taken the place of the acid. The specimen is then examined in the coloring solution, the thin layer of which left under the cover-glass after soaking up the excess with filter-paper not interfering with a clear field The capsules are then very distinct, but often not in water or after mounting in balsam. The width of the capsule varies from one-half to twice the thickness of the bacillus, these differences depending on the exact method of treatment as well as on actual differences in thickness. The outer margin of the capsule is stained, leaving as a rule a clear zone immediately around the bacilli. We have been most successful in demonstrating the capsules in cultures in plain agar and in the blood of rabbits

Various involution forms are found in old cultures The most remarkable ones were observed in five per cent and ten per cent sugar gelatine cultures a month old Here we observed long threads, sometimes reaching through several fields of the microscope (homogeneous immersion 1/12), thin rods, thick rods, irregularly swollen, varicose rods, pear-shaped rods, exquisite spiral forms, curved and bent forms, rods with distinct capsules without special staining, and various irregularities in staining. Fresh cultures from these old ones were pure of the typical bacilli. In an agar culture four months old we observed also remarkable involution shapes, including some very small, coccus-like forms and capsules containing small stained particles or even empty. On the other hand a sugar bouillon culture of the same age was nearly free from involution forms, and a sealed tube containing an agar culture 89 days old was also nearly devoid of unusual forms

The bacillus does not form spores

Cultures - The bacillus is capable of growth upon all of the ordinary culture media It grows best at temperatures of 35°-37°C., but it grows also at ordinary room temperatures (18°-20° C.) It is anaerobic. No growth takes place in plain or in sugar bouillon without removing the oxygen In solid media, gelatine and agar, inoculated as soon as solidified after thorough steaming, it grows in the deeper layers even when the air has free access to the tube For making anaerobic cultures various procedures were adopted, but the one found most convenient, and which we used chiefly, was to place the tubes in narrow cylindrical jars (a little higher than the length of the test tubes) containing pyrogallic acid and ten per cent caustic potash solution, according to the method recommended by Buchner.1 Although the oxygen is not as completely displaced by this method as by some others, it is sufficiently absorbed for our purpose. The stopper of the jar was sealed with a thick layer of paraffin

Cultures in nutrient agar-agar — Gelatine and agar tubes were usually inoculated as soon as the medium was solidified after thorough steaming by which the air is temporarily displaced. For cultures in high agar or gelatine the tubes were filled one-third

¹ Buchner Centralblatt f Bakteriologie, 1888, Bd IV, p 149

to one-half of their height with the medium. Stab cultures were made with a long platinum needle reaching to the bottom of the tube.

These cultures in ordinary neutral or alkaline nutrient agar to which the air has free access through the cotton plug show a good growth at the end of 24 hours at body temperature colonies in the lower part of the needle track are larger than those above, the uppermost ones being very minute. The growth reaches to a variable height beneath the surface ceases about 10 to 12 mm below the surface when the tube has been inoculated after sufficiently prolonged steaming (p 85) to displace all of the air. In other cases it may not come within 3 to 4 cm of the surface. After artificial cultivation for several generations the growth seems to approach nearer the surface than at first. The colonies are grayish white to a more opaque white or even brownish white color by transmitted light, sometimes with a central darker dot, the opacity of the color depending upon the thickness of the colony. The largest colonies at the end of 24 hours do not exceed 0.5 to 1 mm in diameter. They may subsequently attain a diameter of 2 to 3 mm. or even larger. They appear as spheres or ovals, generally more or less flattened, with usually irregular contours, the irregularity being due to little projections or prongs from the surface of the colonies, these irregularities being more evident with a loop than with the naked eye The colonies may appear as little irregular masses with projections After several days or weeks, single, well separated colonies may attain a large size and be surrounded with projections either in the form of little knobs or spikes or of fine branching hair-like or feathery processes In the former case the colonies present a mulberry or thornapple appearance, in the latter they may be compared to spherical white thistle-balls or powderpuffs. Such colonies in old cultures sometimes reach one cm. in diameter. Similar feathery projections may be present in places where the stab growth is continuous.

Bubbles of gas make their appearance in plain agar as well as in sugar agar, although less abundantly in the former, and sometimes not appearing until after 24 hours. These bubbles first

appear in the line of growth, but they are soon present throughout the agar, often at a distance from the actual growth. Fluid is pressed out into the spaces occupied by the bubbles as well as upon the surface of the agar, and this fluid may be turbid from the presence of bacilli. The production of gas is less abundant at room temperatures than at that of the thermostat (35°-37° C). There is usually no very distinctive odor to be appreciated from the cultures in gelatine or agar, but there is an odor, not easily described, not putrescent, something like that of stale glue, and this odor is in some cultures more pronounced than in others. It was sometimes noticed that when the agar cultures were thoroughly crushed in a little bouillon a foul odor can be detected.

Nutrient agar containing one per cent glucose permits a much more rapid and luxuriant growth and especially more abundant and speedy gas-formation than does plain nutrient agar the growth in high layer comes nearer the surface, often within 2 to 3 mm when the air has free access to the tube through the cotton plug Neutral or slightly alkaline media were employed, and these were turned strongly acid by the growth of the bacillus. In anaerobic cultures in sugar agar made according to Buchner's method the production of gas is so great as often to split the agar and force it into the upper part of the tube In these anaerobic cultures there is of course less difference between the size of the colonies in the lower and those in upper layers, and the growth usually comes to the surface, but does not spread out there Generally an excessive quantity of fluid accumulates on the surface, and this is turbid from the presence of the bacilli. The agar is not liquefied by the growth of the bacilli

Cultures in nutrient gelatine—The bacillus grows in ordinary neutral or alkaline nutrient gelatine, but not so well as in that containing glucose. Gas is formed in both media, but much more abundantly in sugar gelatine—5 per cent gelatine is much better than 10 per cent gelatine for the development of the bacillus. The bacillus is best classed among the non-liquefiers of gelatine, although in anaerobic cultures in 5 per cent sugar gelatine there may be slight softening due to peptonization of the gelatine over a limited area, as is made manifest by the settling of the growth

toward the bottom of the line of puncture in stab cultures, and by slight displacement of the gas-bubbles in changing the position of the tube. Cultures in gelatine which have developed at 35°-37° C. become solid upon cooling the tube. In gelatine cultures at 20°-23° C. in high layer to which the air has free access through the cotton plug, the growth occupies the lower third to one-half of the medium, not reaching as near the surface as in agar cultures at body temperature. The appearance of the colonies in gelatine does not differ especially from that of those in agar

Cultures in bouillon.-We have not noticed any development of the organisms in tubes of bouillon to which the air has free access, but the growth is abundant in anaerobic cultures in both plain and sugar bouillon In sugar bouillon there is very abundant gas-formation, small bubbles accumulating on the surface so as to form often a foamy layer As soon as the development of the organism begins it goes on with extreme rapidity, so that clear bouillon may become very cloudy with an abundant sediment in two or three hours. The development in sugar bouillon is well marked in Buchner's jars in less than 18 hours. The diffuse cloudiness of the bouillon gives place to a clearer or even an absolutely clear and transparent appearance in the course of a few days by the settling of the sediment. This sediment is abundant, white, uniform or sometimes flaky. Upon shaking it floats up in viscid threads or cloud or, if in flakes, can be readily broken up so as to mingle uniformly with the fluid and produce diffuse cloudiness, or it may be in the form of little specks less easily disintegrated by shaking and quickly settling again upon standing. The reaction of the sugar bouillon is of course strongly acid after the development is completed The odor of bouillon cultures is like that of agar cultures and may be compared to sour stale glue. It is not a distinctly putrescent odor.

Cultures in milk.—Growth is speedy and abundant in anaerobic milk tubes at body temperature, but was not observed in tubes exposed to the air. In 24 to 48 hours the milk is coagulated, the clot being either uniform or firm, retracted and furrowed with the marks of gas-bubbles which develop abundantly. In milk

colored with blue litmus, which is of course completely decolorized simply by absorption of oxygen in anaerobic cultures, the coagulated milk becomes deep pink upon exposure to the air

Cultures upon potato—In potato tubes prepared according to Bolton's method¹ and put in the Buchner jars and kept at body temperature, abundant gas-formation occurs in 24 hours in the fluid accumulated around the bottom and sides of the potato, which thus becomes surrounded with a frothy fluid (p 86) After complete absorption of the oxygen there appears a thin, moist, grayish-white growth on the surface of the potato.

The bacillus grows well with formation of gas-bubbles in ascitic

fluid in anaerobic culture

Vitality.—As already mentioned, the bacillus forms no spores The vitality of the cultures is of very variable duration, according to the character of the medium and the mode of cultivation Cultures in sugar bouillon in Liborius tubes in which the oxygen was replaced by hydrogen we found to be dead in three days and they may die sooner. On the other hand we found a sugar bouillon culture kept for 123 days in Buchner's jar at body temperature to be still living. The same was true of a culture in plain agar. Cultures in sugar agar are shorter-lived than those in plain agar and may be dead in 28 days or even less. A culture in plain agar exposed all of the time to the free entrance of air through the cotton stopper had a few living bacilli at the end of 84 days, although most of the organisms were dead. Cultures in sugar gelatine appear to be longer-lived than those in sugar agar, and cultures kept in Buchner's jar longer-lived than those in which the air can enter. There were curious and not readily explained differences in the vitality of the cultures, some being still alive which were under apparently the same conditions and of the same age as those which proved to be dead A convenient way of keeping the cultures alive for a long time is to seal the agar tubes hermetically after two or three days' growth.

Thermal death-point—This was tested according to Sternberg's method² on fresh bouillon cultures These were killed by ex-

¹ Bolotn The Medical News, 1887, Vol I, p 318

² Sternberg Am Journ of the Med Sciences, July, 1887, p 146

posure for ten minutes to a temperature of 58° C. They were not completely killed by the same temperature after five minutes.

Inoculation of animals—Quantities up to two and one-half

Inoculation of animals—Quantities up to two and one-half cubic centimeters of fresh cultures in sugar bouillon and of suspensions in salt solution or bouillon of fresh agar cultures were inoculated into the ear veins of rabbits without any manifest symptoms, the animals surviving Larger quantities were not employed. In only one instance was a rabbit killed by intravenous inoculation, and this case will be described later. We cannot therefore consider this bacillus as pathogenic for healthy rabbits under ordinary conditions

If, however, the animal be killed after the intravenous injection of the bacilli, then these develop in the vessels, tissues and organs with abundant formation of gas. Upon this point we have made twenty experiments upon rabbits and one upon a dog. The animals were killed at a variable period after the injection As the results of these experiments were uniform and conclusive, it is necessary to give only a few of the protocols as examples

Experiment 1.—Large rabbit 1 cc sugar bouillon culture (the ninth generation from the original case) 24 hours old, which had developed in Buchner's jar at 36° C., showing abundant growth with gas production, was injected into the ear vein and immediately after the injection the rabbit was killed by a sharp blow at the back of the neck. The animal was kept in a room the temperature of which was about 18°–20° C. A control rabbit was killed and kept under the same conditions. At the end of 18 hours emphysematous crackling could be felt in the groins of the inoculated rabbit and elsewhere. The femoral vessels were now exposed and found to be full of gas-bubbles. The autopsy was then made. Peritoneal cavity full of gas. The heart cavities contain soft, dark coagula with lac-colored blood and many gas-bubbles. The blood-vessels, both arteries and veins, are full of gas-bubbles. The abdominal vena cava and other abdominal veins are blown up with a continuous volume of gas. The inner coat of the blood-vessels is diffusely red from im-

bibition of blood coloring matter. The liver is soft, pale and crackling. It is studded with little cavities containing gas. The spleen is soft, crackling and swollen with gas-bubbles. The kidney also contains gas. The tissues around the kidney, the retroperitoneal tissue, the tissues in the groin, over the abdomen, are emphysematous. The gas burns with a bluish flame, and upon ignition a slight explosive sound is heard. Blood-stained fluid in the pericardium and pleura contains gas-bubbles. No odor of putrefaction. Cover-slip preparations from the blood-vessels, liver and spleen show an enormous number of bacilli, like those injected, provided with beautiful capsules easily demonstrable by the acetic acid method. No other species of bacteria are observed. Anaerobic cultures and cultures in high liquefied agar from the blood and spleen prove to be pure cultures of the typical bacilli.

The control rabbit shows no development of gas in the vessels or organs No bacteria are found in the blood, and cultures from the blood are negative

Experiment 2—Full-grown rabbit. 05 cc. 24-hour anaerobic sugar bouillon culture (13th generation) into ear vein. Killed after 5 minutes—Kept for 24 hours under the same conditions as the preceding rabbit—At the end of this period animal much swollen, abdomen distended and tense, emphysematous crackling of subcutaneous tissues. Gas abundant in heart and blood-vessels, serous cavities, spleen, liver and other parts—Bacilli present in large number. Cultures from heart's blood pure of the typical bacilli—Control rabbit free from gas formation in vessels.

Experiment 3—Large rabbit I cc of the same culture as that used for preceding rabbit injected into ear vein. Killed after one hour. The inoculated ear cut off near the base and remaining cut surface burnt. Result as in preceding case, but animal not so much swollen from gas formation.

When the animal is killed shortly after the injection into the circulation and is then kept at temperatures between 30° and

35° C. the development of bacıllı and gas goes on with almost startling rapidity, as is illustrated by the following cases

Experiment 4.-Medium-sized rabbit. I cc. anaerobic sugar bouillon culture (17th generation), 24 hours old, into ear vein. Killed after two minutes and immediately placed in incubator regulated accurately at 32°C. Autopsy made 6 hours after death Abdomen much distended. Emphysematous crackling over thorax, abdomen and inside of thighs. On incision, gas, which burns with a blue flame, escapes freely from the abdominal cavity. Fundus of stomach digested. Vena cava inferior and other abdominal veins appear to contain no blood, but to be blown up with a continuous volume of gas. Abdominal aorta contains gas-bubbles and a little blood, but is not distended heart cavities and blood-vessels everywhere contain gas liver is completely filled with small and larger gas-bubbles, forming a pale, soft emphysematous pulpy mass. Many of the gasblebs at the surface have ruptured. Spleen full of gas-blebs. Gas in kidney. Muscles of thigh and elsewhere streaked with whitish lines containing gas Pleural and pericardial sacs full of Emphysema of sub-pleural and sub-peritoneal tissue. Urmary bladder free from gas Blood lac-colored, with soft dark Typical capsule-staining bacilli in enormous number in the blood, liver, etc. No other species observed. Cultures from the blood are pure of the bacillus injected

A control rabbit killed at the same time and kept in the incubator (p 87) was examined after 8½ hours. It presented beginning greenish discoloration of the abdominal walls. No gas in the heart, blood-vessels, liver or serous cavities. A few bacteria in the portal vein, none found elsewhere in the blood. Cultures from the blood and organs sterile.

This case shows that in the short space of 6 hours after death gas and bacilli have developed at the temperature of 32° C. enormously, and to a greater degree than is observed after 24 hours at ordinary room temperatures

Experiment 5—Large rabbit I cc anaerobic sugar bouillon culture (19th generation), 48 hours old, into ear vein Killed after one minute by blow at back of neck, kept in incubator at 30°C Examined after four hours No subcutaneous emphysema Gas-bubbles in femoral vessels Gas and frothy reddish serum in moderate amount in peritoneal cavity Stomach not digested Vena cava abdominalis distended with large gas-bubbles mixed with dark blood. Smaller gas-bubbles in abdominal aorta. Arteries and veins generally contain gas Gas more abundant in right than in left cavities of heart, in pulmonary artery than in pulmonary veins Liver contains many gas-blebs. Gall-bladder distended with gas Gas-blebs in spleen, gas in pleural cavities, in diaphragm, in sub-serous tissues Blood shows under microscope distorted and pale red blood corpuscles, yellow plasma and leucocytes swollen, presenting molecular movement of granules and round apparently empty nuclei. Typical bacilli in pure culture in blood and elsewhere.

This case shows that at the temperature of 30°C the bacilli and gas have developed to a marked degree within 4 hours after death, the animal having been killed one minute after intravenous injection of I cc bouillon culture. The dead animal body evidently offers the most favorable conditions possible for the growth of the bacillus. This growth is many times more rapid at warm temperatures than at temperatures below 20°C

Several experiments were made to determine the difference in time required for the development of the bacilli with formation of gas throughout the blood-vessels when the organisms are introduced only at one point in the vascular system after death and when they are distributed, as in the preceding experiments, Just before death throughout the circulation

Experiment 6—Large rabbit Killed by chloroform Four hours after death a small window was cut in the thorax, the surface of the left ventricle singed with a hot knife, and two loopfuls from a 72-hour anaerobic agar culture (7th generation) thrust into the left ventricle The rabbit was kept in the room

at a temperature of 18° to 20°C. After 24 hours the femoral vessels were exposed and found to be free from gas. After 48 hours gas was found in the femoral artery, but none in the vein. The autopsy was then made. Gas-bubbles quite abundant in all of the arteries, also in both sides of the heart, pulmonary vein, pulmonary artery and venae cavae near the heart, but none was found in the veins elsewhere, and none in the liver, spleen or connective tissue. Cover-slip preparations from the heart and aorta show the characteristic capsulated bacilli in large number, but no bacilli are found in the abdominal vena cava, the femoral vein or the liver. Cultures from the blood in the thoracic aorta are pure of the same bacillus, those from the abdominal vena cava are sterile.

In this case, therefore, at room temperature the bacilli after 48 hours had not made their way into the veins except those near the heart, but had grown throughout the arteries, whereas after 18 hours in experiment 1, in which the bacilli had been introduced into the circulation just before death and the rabbit had been kept under the same conditions, all of the vessels and organs and serous cavities were full of gas and bacilli.

In the following experiment the culture was introduced into the right ventricle shortly after death and the animal was kept at the temperature of 32° C.

Experiment 7.—Rabbit killed by blow at back of neck One-half hour after death heart exposed, and after singeing the surface, o 5 cc of the same sugar bouillon culture as that used in experiment 4 injected with fine hypodermic needle into right ventricle, no air being permitted to enter. This rabbit was kept together with that of experiment 4 and a control rabbit in the incubator at 32° C and was examined after $7\frac{1}{2}$ hours. No subcutaneous emphysema. No gas in femoral artery or vein. No gas in peritoneal cavity, liver, spleen or kidney. Stomach not digested. Gas-bubbles in abdominal vena cava, renal, portal, hepatic veins, in veins near the heart, in both sides of heart, pulmonary artery, pulmonary veins and thoracic aorta, none in abdominal aorta.

The gas is most abundant in vessels leading to or from the right heart, and is in comparatively small amount in the vena cava in the abdomen. Cover-slip preparations show numerous typical bacilli in pure culture wherever gas is present. The bacilli are abundant in a smear preparation from surface of lung. None are found in the abdominal aorta (The control rabbit of experiment 4 served also as the control for this experiment)

If the result of this experiment be compared with that of experiments 4 and 5 in which the autopsies were made after 6 and 4 hours respectively, it is evident that it requires a much longer time even at high temperatures for the bacilli and gas to develop throughout the vessels and organs when they are introduced at one point after death than when they have been distributed throughout the circulation just before death, a result which of course might have been predicted.

The last two experiments are also interesting as showing that the bacilli first grow in the course of the circulatory channels into which they have been introduced, in experiment 6 along the arteries and in experiment 7 along the veins, and in both cases through the pulmonary circulation

Of all of the organs of the body the liver appears to offer the most favorable conditions for the rapid development of the bacillus after death and the formation of gas. Some of our observations seem to indicate that the bacilli develop sooner in the veins than in the arteries, but our attention was not directed sufficiently to this point to justify a more positive statement.

The length of time that the bacilli injected into the circulation may survive in the living body we have not accurately determined, but they may persist for at least 48 hours and probably longer. It requires a longer time for the bacilli and gas to appear throughout the vessels when the animal is killed several hours up to two days after the injection than when it is killed immediately These points are shown by the following experiment.

Experiment 8—Large rabbit 1 cc 48-hour sugar bouillon culture (16th generation) in ear vein Killed after 48 hours by

blow on back of neck Kept for five hours at temperature of 32° C and then at temperature of 20° C. Autopsy after 32 hours. Animal enormously swollen. Subcutaneous emphysema Abdomen distended with gas. Vessels and liver full of gas Enormous number (p. 88) of bacilli in blood and organs. Cultures from blood pure of the characteristic bacilli.

Out of six experiments upon rabbits to determine the pathogenic effects of the bacillus, only one died from the effects of the inoculation, and this afforded an interesting result

1 cc. sugar bouillon culture Experiment 9—Pregnant rabbit (9th generation), 48 hours old, into ear vein Rabbit was found dead 21 hours after the inoculation, the body being still warm, although stiff It was alive one-half hour previously and apparently in good condition. The autopsy was made 6 hours after death. By this time the body, which has been in a room at the temperature of about 18°C, is much swollen, the abdomen distended, and emphysematous crackling can be felt over the abdomen and the lower part of the thorax Bloody fluid containing gas-bubbles oozes from the vagina. On opening peritoneal cavity gas escapes freely, which burns with a colorless flame, a slight explosive sound being heard upon first applying the match This cavity contains blood-stained fluid. Bloodvessels, both veins and arteries, contain gas. The heart cavities on both sides contain soft dark clots with gas-bubbles is somewhat enlarged, soft and dark red. Liver does not contain gas-blebs, but gas is present in hepatic vessels. The inferior vena cava is blown up with gas. The uterus contains 6 embryos about 3 cm long The dilatations of the uterus corresponding to these embryos are greatly distended with gas sacs are more distended than the rest, their walls are very thin, contain gas-bubbles, and look as if they were just ready to burst The embryos in these two sacs are macerated, dark livid red, partly destroyed and smaller than the rest, which are intact The placentae contain gas-bubbles in large amount

Cover-slip preparations show an enormous number of characteristic capsulated bacilli in the distended uterine sacs, a large but not so great number in the liver, spleen, heart and blood

vessels Cultures from the uterus, spleen and left ventricle are pure of the typical gas-forming bacillus which was used for the injection

The preceding case is instructive as showing that under special conditions the injection of cultures of the bas bacillus may prove fatal. The special condition existing in this rabbit and not in any of the others used for these experiments was pregnancy. It seems probable from the autopsy that two of the embryos in the uterus were already dead when the injection was made, and that in these embryos and the part of the uterus containing them the bacilli were able to gain a foothold and develop

The case is especially suggestive in view of the number of cases which have been reported of death from supposed entrance of air into the uterine veins after abortions and injections into the uterine cavity. It will be noted that the autopsy was made in six hours after the death of the animal, and that already the vessels and peritoneal cavity were full of gas and that there was subcutaneous emphysema, a condition not found when the animal is killed immediately after the injection of the cultures, kept at room temperature, and examined at that short period after death

Conclusions from the experiments—Our experiments, although they have not settled all of the points which suggest themselves as to the relation between our gas-producing bacillus and the animal body, have settled the principal questions which we had in mind when we began the experiments. We may draw the following conclusions from these experiments on animals

The bacillus is not pathogenic under ordinary conditions for healthy rabbits in doses up to 25 cc of fresh bouillon cultures. Doses of one cubic centimeter may, however, under especial conditions, prove fatal, the special condition in our experiment being pregnancy probably associated with the death of two embryos either before or soon after the injection.

The bacillus develops rapidly in the blood after death, with formation of gas.

If the animal be killed immediately or soon after the intravenous injection of 0.5 to 1 cc. bouillon culture, after 18 to 24 hours

at the temperature of 18°-20° C and after 4 to 6 hours at temperatures from 30° to 35° C. the bacilli are found abundantly, together with great formation of gas in the blood-vessels and organs.

When the animal is killed several hours up to two days after the intravenous injection it takes a longer time before the bacilli develop throughout the vessels and tissues with gas formation, than when the animal is killed at once after the injection.

When the bacilli are introduced at one place in the vascular system soon after death, they develop in the course of the vessels into which they are introduced, and the time required for them to appear with gas formation throughout the vessels is at least two or three times as long as when the bacilli have been distributed throughout the circulation just before death.

It is noteworthy that in the instance in which the pregnant rabbit died from the effects of the inoculation death was sudden, and that within six hours after death the vessels contained gas and bacilli in large amount.

All of the conditions relating to the bacilli and their production of gas which existed at the post-mortem examination of the patient J M were produced experimentally in animals by inoculation of pure cultures of the bacillus isolated from the body of the patient.

It is our intention to continue the experiments in order to determine more accurately how long the bacilli may survive in the body of a living animal, how they are disposed of there, and the possibilities of their exerting pathogenic effects under certain circumstances.

In endeavoring to select a name suitable for the bacillus described in this article we have thought of several designations, such as the following: Bacillus aerogenes capsulatus, bacillus sanguinis aerogenes, bacillus aerogenes cadaveris, bacillus pneumathaemiae. (The name pneumathaemia was introduced by Cless to designate the presence of air in the blood) Upon the whole we prefer the first name, bacillus aerogenes capsulatus. The presence of a capsule does not appear to be constant, but it is common and forms a characteristic feature of the morphology of the bacillus.

We have not been able to identify the bacillus with any hitherto described, but the descriptions of some of the gas-producing bacilli have been so meager and unsatisfactory that it is possible that others have found the same organism. We find indeed records in our laboratory notes of encountering from various sources obligatory anaerobic gas-producing non-motile bacilli, some of which may have been identical with the present one, but these organisms were not studied sufficiently to establish their identity and the cultures have not been kept There is a note of finding such a bacillus in the human lung at autopsy, but there was no gas production in the body. We (p. 89) think it likely that our bacillus aerogenes capsulatus is not an uncommon species. The bacillus described by E Frankel, in a case of gastritis emphysematosa may have been identical with ours, but it was studied only on hardened specimens of the stomach. There may of course also be other bacteria capable of producing similar effects in the animal body.

We will now review briefly the main points in the case which formed the starting point of our investigations, and consider the bearing of the case upon other similar ones recorded in medical literature.

A patient with chronic pulmonary tuberculosis, acute miliary tuberculosis and a large sacculated aneurism of the ascending arch of the aorta, which had ruptured in two places through the anterior thoracic walls, died suddenly after repeated copious hemorrhages from the aneurism, but not immediately after the loss of blood The autopsy was made in cool weather eight hours after death while the body was still warm, there being no odor or evidence of ordinary cadaveric decomposition present heart and blood-vessels everywhere were found to contain gasbubbles in large amount, gas was also present in the subcutaneous connective tissue in some places, in the heart-muscle, liver and There was a solution of the blood coloring matter other organs evidenced by the color of the blood, the diffuse red staining of the inner coat of the vessels and of the tissues in the pelvis of the kidney The bacterioscopic examination of the blood revealed the presence of non-motile, capsulated bacilli in very large num-

¹E Frankel Virchow's Archiv, Bd 118, p 526, 1889

ber wherever gas was found, and no other species of microorganism could be detected. This bacillus was isolated in pure
culture and found to be an obligatory anaerobe. Its morphological and biological properties were studied and have been
described. An exact reproduction in every particular of the
condition in the body relating to the presence of gas and changes
caused by the bacillus was obtained by the injection of pure
cultures of the bacillus into the circulation of rabbits shortly
before killing the animal. No accurate determination of the gases
produced by the growth of the bacillus was made save to establish
by ignition the presence of hydrogen both in the original case and
in the experimental animals

There can be no doubt that the gas found in the vessels and organs at the autopsy on the patient was not atmospheric air, but was produced by the growth of the bacilli. The questions which at once suggest themselves are Were these bacilli distributed throughout the circulation before the death of the patient? At what point did they enter the circulation? Were they concerned in causing death? An unequivocal answer cannot be given to these questions

As regards the first question, the experiments upon animals speak strongly in favor of the view that the bacilli had entered the circulation before death. When these bacilli were introduced into the heart of the rabbit after death, it required so much longer for them to spread throughout the vessels and organs with gas formation as compared with their development when the bacilli were previously carried throughout the body by the circulation, that it seems doubtful that in the short space of eight hours, the body being kept in a cool place, the bacilli starting at one point could have developed so extensively and have produced so much gas throughout the vessels and organs as were found at the autopsy on the patient Even when the animal was kept from the time of death at a temperature of 32° C. the bacıllı which had been introduced after death into the right ventricle had not made their appearance in the abdominal aorta or the peripheral veins or produced gas-blebs in the liver after 7½ hours (experiment 7) On the other hand we have experimental evidence of quite

as rapid post-mortem development of bacilli and gas as that occurring in the patient J M when the organisms have been previously introduced into the circulation. It may, however, be urged that special conditions favoring the growth of the bacilli, such as the disappearance of oxygen and possibly of other restraining influences of the fluids and cells, may have appeared in the anemic body of the tuberculous patient at an earlier period after death than they do in the previously healthy animal.

Regarding the point of entrance of the bacilli it seems to us probable that they entered the aneurismal sac through the external openings in the chest wall. The sac of the large aneurism was nearly filled with laminated ante-mortem coagula. conditions would seem to be suitable for the development of the bacilli in this thick clot, in the deeper parts of which we may suppose the oxygen to be in so small an amount as to permit the growth of the bacillus. The excellent development of the organism in fluid cultures with Buchner's method of anaerobic culture before there has been time for complete absorption of the oxygen, and the height to which it grows in solid agar cultures, indicate that it is not so susceptible to the restraining influence of a small amount of oxygen as are some strictly anaerobic organisms, and we believe therefore that it could find conditions for its growth in the thick clot of the aneurism, which was virtually shut off from the circulation, as well as in high layers of gelatine and agar exposed to the air. The aneurismal clot was found at the autopsy to be riddled with gas and discolored around the gas and to contain in enormous number the bacilli, in apparently pure culture There was no other place in the body where equally favorable conditions for the growth of the organism were present unless it be in the intestinal canal, and the possibility of the entrance of the bacilli from the latter source cannot be absolutely excluded.

If, as seems quite possible, the bacilli had entered through the ulcerated openings the clots of the aneurism and effected growth there before death, then the conditions seem to have been such as to permit the escape of gas into the circulation during life, the bacilli being also carried in just as they are carried to the surface of agar cultures by the escaping gas The reduction of the blood

pressure by the extremely exhausted and anemic state of the patient would be a factor favoring the escape of the gas into the circulation. The splitting and elevation of masses of agar in our cultures show that the developing gas is capable of exerting considerable pressure. It seems to us therefore by no means impossible that the entrance of gas and of bacilli into the circulation from the aneurism may have been concerned in the death of the patient, which, as already stated, was sudden. Nevertheless we would express ourselves with reserve on these points. There were present (p. 90) other conditions sufficient to cause death, even sudden death; but in the light of experiments upon animals, all of the circumstances of the case seem best explained upon the supposition that the bacilli had begun to grow in the aneurismal clot and were carried into the circulation before death.

The experiments upon animals show that the bacilli are incapable of development in the circulating blood during life, as might have been predicted from the anaerobic character of the organism. If, however, the bacilli should find access to dead tissue, old fibrinous clots, cavities such as the intestine or uterus, under conditions where the amount of free oxygen is reduced to a minimum, there they might grow, and if the places where they develop communicate with the circulatory channels, then the gas produced and with it the bacilli might enter the circulation.

As is well known a large number of cases have been reported during the last seventy years of death in human beings attributed to the entrance of air into the veins, and a large amount of experimental work has been done both before and since this period in regard to the effects of the entrance of air into the circulation.

The experiments have shown that the sudden introduction of a large amount of air into the veins of rabbits and dogs is fatal, the lethal quantity for dogs when rapidly injected into the jugular vein varying according to Nysten¹ from 40 to 120 cc., according to the side of the dog Smaller quantities than this have, however, proved fatal to dogs Hare,² who also found that quantities

¹ Nysten Recherches de physiologie et de chimie pathologiques Paris, 1811

² Hare Therapeutic Gazette, Sept 16, 1889

short of 40 cc. did not kill dogs, believes that no such amount of air as would cause death in human beings can enter a vein injured by the surgeon's knife. While it is true that many of the cases reported as deaths due to entrance of air into veins opened by the surgeon are unsupported by any satisfactory evidence that this was the cause of death, still we cannot agree with Hare that all of the reported cases are of this character. The evidence seems to us conclusive in some of the cases that death really resulted from the sudden entrance of air.

When the air is introduced slowly and at intervals, enormous quantities can be injected in a comparatively short time without manifest injury. Thus Laborde and Muron¹ injected into the external jugular vein of a dog 1120 cc. in the space of one hour and a half without causing death, and Jurgensen² injected into the left femoral artery of a narcotized dog weighing 43 5 kilo, 3650 cc in the space of two hours and twenty-five minutes with only slight disturbance of the respiration and of the action of the heart. Under these circumstances the air-bubbles pass through the capillaries and circulate with the blood, but of course with such enormous quantities much of the air must be speedily eliminated.

The reported cases in human beings in which death has been attributed to the entrance of air into the circulation may be brought for the most part, although not wholly, into the following classes surgical operations, especially about the neck, shoulder and skull, cases in which the air has entered the uterine veins, chiefly from the puerperal uterus, either spontaneously as after attempted abortions, or after injections into the uterine cavity, cases in which the air has entered from the stomach or intestine, and cases in which no point of entrance for the air could be detected

We have already expressed our belief in the credibility of some in the first class of cases We see also no reason to question a similar interpretation of such a case as that reported by Vogel, in which a caseous lymphatic gland had brought about a commu-

¹ Laborde and Muron Comptes rendus de la Soc de Biologie, 1873, t V

² Jurgensen Deutsches Archiv f klin Med, Bd 31, p 458, 1882 ³ Vogel, Berliner Wochenschrift, 1882, No. 12

nication between the right subclavian vein and a large bronchus. Death was instantaneous, and at the autopsy large air-bubbles were found in the blood and in different abdominal organs.

The evidence is also strongly in favor of the view that some of the sudden deaths in the puerperal state which have been attributed to the entrance of air into the uterine sinuses, especially after injections of fluid and air into the cavity of the uterus, are in fact due to the assigned cause.

In 1882 Jurgensen¹ reported a case of sudden death of a patient with gastric ulcer which had bled profusely shortly before death. At the autopsy 22 hours after death gas was found in the bloodvessels, the peritoneal cavity, the pericardial sac, the subperitoneal tissue, the spleen and the liver, which was emphysema-In the floor of the ulcer, which had not perforated into the peritoneal cavity, was found an open vein, probably the splenic, 3 to 4 mm in diameter. Jurgensen believes that the air found post-mortem in the vessels entered the circulation during life through the open vein in the floor of the ulcer, passed through the portal capillaries into the hepatic veins to the inferior vena cava and the right heart, thence through the pulmonary circulation to the left heart and the systemic circulation. This interpretation seems to us altogether improbable, and one of us2 in 1885 suggested that in this case the gas developed in the vessels after death, attention being called to the presence of gas elsewhere than in the blood-vessels in this case, a point which Jurgensen does not consider in his first report In 1887 Jurgensen³ reported another case occurring a few months after the first, in which a gastric ulcer had perforated into the peritoneal cavity. At the autopsy, 22 hours after death, gas was found in the peritoneal and pleural cavities, the heart, arteries and veins, and the subcutaneous tissues of the abdomen There was beginning green discoloration of the abdominal walls No vessels with ulcerated openings were found in the ulcer or elsewhere This case is

Jurgensen Deutsches Archiv f klin Med, Bd 41, p 569, 1887

¹ Jurgensen, loc cit ² Welch A System of Practical Medicine by American Authors, edited by William Pepper Vol II, p 510 Philadelphia, 1885

interpreted by Jurgensen in an entirely different manner from the first, the gas in the vessels as well as that in the serous cavities and connective tissue being attributed to a gas-generating something, presumably a microbe, but he thinks the gas was developed in the circulation partly during life because just before death the jugular veins on the right side of the neck were observed to swell up, a phenomenon (p 91) noted also in the first case. In the light of our case and of the investigations reported in this article these cases are open to a clear and satisfactory interpretation without recourse to the adventurous hypothesis advanced by Jurgensen in his first article

A considerable number of cases are to be found in medical literature in which gas, which could not be explained as due to ordinary cadaveric decomposition, was found in the bloodvessels after death, without any opening through which air could enter the circulation In some the death was sudden, and no satisfactory cause of death could be found except the gas in the blood. Some of these cases are very curious, as will be seen by those who consult the works of Cless¹ and Couty.² Most writers dismiss these cases as unworthy of credence, or as referable to ordinary post-mortem decomposition, or as attributable to the entrance of air during the post-mortem examination. Some of the older writers and even modern ones have seriously discussed the possibility of the spontaneous generation of air or gas in the circulating blood during life as an explanation of these cases. Ewald and Kobert3 believe that they have found the key to their solution by their demonstration that the lungs during life are not air-tight, but apparently without rupture permit under pressure air to be forced through which makes its appearance in the pleural cavities and in the blood of the heart and elsewhere Our observations reported in this article suggest an explanation of some of these cases more satisfactory than those hitherto offered.

Fischer,4 in his well-known paper on the dangers of the entrance

¹ Cless Luft im Blute Stuttgart, 1854

² Couty Etude experimentale sur l'entree de l'air dans les veines et les gas intravasculaires These, Paris, 1875

² Ewald and Kobert Pfluger's Archivf d gesammte Physiologie, 1883, Bd 31, p 182

⁴ Fischer Volkmann's Sammlung klin Vortrage, No 113

of air into the veins, justly says. "The weakest part of the entire doctrine regarding the entrance of air into the veins of human beings during an operation is the extremely variable and undemonstrative character of the recorded autopsies." Although he does not say so, he evidently quotes from Greene's article, which is the best consideration of the literature of the subject which has come to our notice in the English language up to the date of its publication (1864), in giving the number of autopsies as only eighteen and in stating that in only six of these is there any statement as to the length of time between death and the post-mortem examination, in five of these cases the time being 18 to 26 hours and in one 52 hours.

May reports a case of sudden death in the puerperal state in which the autopsy was made 6 hours after death, and in which he considers that the presence of air in the vessels was the only cause to which death could be attributed ² At the other extreme is a case for which the same explanation is accepted and in which the vessels were examined for the presence of gas five days after death.

Any one who will examine with a critical spirit the reported cases of death from the entrance of air into the vessels will be impressed with the unsatisfactory and meager evidence upon which this conclusion as to the cause of death is based in the majority of the cases In some of the cases the gas found in the vessels was associated with the most ordinary advanced postmortem decomposition, which, as is well known, in some conditions may set in with great rapidity Had there been no bacteriological examination in our case, the evidence in support of the view that air had entered the vessels during life would have been indeed stronger than in most of the reported cases patient had been weakened by copious hemorrhage, which in the writings on the subject is regarded as an important predisposing A communication existed between the external air and an ıntra-thoracıc vessel Death was sudden. The autopsy. made in cool weather eight hours after death without the slightest

Greene Am Journ Med Sciences, 1864, Vol 47, p 38

May Trans Path Soc London, 1858, Vol IX, p 158

visible sign or odor of post-mortem decomposition, revealed gas in large quantity in the vessels

We have not been able to find any report of a bacteriological examination of the blood in the cases in which gas supposed to be air entering during life has been found in the vessels after death, and it is certainly surprising that no attempt has been made to determine by bacteriological examination whether or not what was taken to be atmospheric air might not be generated by the growth of a micro-organism. The result of the examination in our case must necessarily cast doubt upon the interpretation hitherto accepted in many of the cases reported as death due to the entrance of air into the veins A principal link in the chain of evidence has fallen out, viz, the belief that when the gas is found in the heart and vessels a few hours after death without any evidence of cadaveric decomposition, this is a proof that the gas is air, and is not the result of the development of a micro-organ-Hereafter in all similar cases a careful bacteriological examination, including anaerobic cultures, must be made before it can be admitted that the gas in the vessels has not been generated by micro-organisms Time only can determine whether such examinations will show that the explanation found to be correct in our case is exceptional or is applicable to many other cases which might otherwise be interpreted as due to the entrance of air into the vessels



Morbid Conditions Caused by Bacillus Aerogenes Capsulatus

The Shattuck Lecture¹

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this lecture relates for the most part to infrequent affections, the scientific and practical interest attaching to them is considerable and varied. Many instances of the presence of free gas in parts of the body where it does not

normally occur and in association with various diseases were recorded by writers of past centuries and were even then the subject of much speculation. The discussion turned generally around the question whether the gas was atmospheric air or the

Delivered before the Massachusetts Medical Society, June 12, 1900

result of putrefaction—a question which in most cases could be solved only by bacteriological examinations. The most numerous and important of such examinations have been made during the last decade, and, although these have left problems still unsolved, they have corrected many current errors and have shed a flood of light upon conditions which were formerly among the most mysterious in pathology.

While it has been demonstrated that various bacteria may be concerned in producing gaseous affections, it is now evident that the bacillus which I discovered in 1891, and to which I gave the name Bacillus aerogenes capsulatus, is the one whose causative agency is best established and most frequently in action. What I shall say will relate mainly to this microorganism and its pathogenic effects.

Historical.—As a certain amount of confusion concerning (p. 186) the dates of the first publications² on this bacillus exists in foreign literature on this subject, it may be well to state that I reported my observations in November, 1891, to the Johns Hopkins Hospital Medical Society and that the full report of these observations and of the characters of the bacillus was published in July-August, 1892, by Dr. Nuttall and myself.³ E. Fraenkel's first publication⁴ was a short preliminary one which appeared in January, 1893, and was followed in the same year by his valuable monograph on gaseous phlegmons.⁵ In August, 1893, one year after the publication of the paper by Nuttall and myself, appeared simultaneously the interesting articles of P. Ernst⁶ and of Graham, Steward and Baldwin⁷ on foamy organs Early in 1894 Mann published from my laboratory an observation of em-

²Levy's description in 1891 (Deutsche Ztschr f Chirurg, XXXII) of "kleine, feine" bacilli, cultivated from a gaseous abscess and growing in long threads and chains only at body temperature and cultivable only in the first generation, without animal experiments, cannot be accepted as an identification of B aerog capsulatus, or indeed be readily reconciled with its characters

³ Bulletin of the Johns Hopkins Hospital, 1892, III, p 81

Centralbl f Bakter, XIII, p 13

⁶ Ueber Gasphlegmonen Hamburg u Leipzig, 1893

⁶ Virchow's Archiv, CXXXIII, p 308

Columbus Med Journ, XII, p 55

physematous gangrene caused by Bacillus aerogenes capsulatus,⁸ and in January, 1896, Dr Flexner and I published an extensive paper reporting twenty-three human cases, including not only six personal observations of emphysematous gangrene but also examples of submucous gas-cysts, pneumoserositis, and various other pathogenic manifestations of this bacillus ⁹ In July, 1895, appeared Goebel's preliminary communication,¹⁰ and in the following year his full paper on the bacillus of foamy organs ¹¹ Of the subsequent records the most numerous and valuable have appeared in this country, although they appear to be little known to most European writers ¹² I shall have occasion to refer later to many of these publications, among which those of Dunham, Dobbin, Norris, Bloodgood, Howard, Nicholls, and Pratt and Fulton, may here be mentioned as especially valuable

Nomenclature — Dr. Fraenkel has kindly favored me with cultures of the bacillus which he isolated from gaseous phlegmons and to which he gave the name "Bacillus phlegmones emphysematosae" There can be no question whatever but that his bacillus is identical with our Bacillus aerogenes capsulatus, a point upon which we are both agreed, and which is also made certain by Goebel's studies under Fraenkel's supervision According to the generally accepted principles of the nomenclature of zoological and botanical species, the name "Bacillus aerogenes

8 Annals of Surgery, XIX, p 187

⁹ Journal of Experimental Medicine, 1896, I, p 5

¹⁰ Centralbl f allg Path u path Anat, VI, p 465

¹¹ Jahrb d Hamburgischen Staatskrankenanstalten, IV

Thus v Hibler in 1899 (Centralbl f Bakt, XXV, p 513 et seq), in an elaborate study of pathogenic anaerobes, is entirely ignorant of our work and that of other American investigators on B aerog capsulatus. The information of Hitschmann and Lindenthal (Sitzungsb d k Akad d Wiss, Math-Naturw Cl, Wien, 1899, CVIII, Heft 3, Abth III, p 67) on the American work is secondhand and both incomplete and inaccurate, in these respects being in unfavorable contrast to that of Muscatello, assisted by Gangitano (Riforma Med, 1900, II, p 508 et seq), who write also on the subject of emphysematous gangrene. Knowledge of Bacillus aerogenes capsulatus, under the name "Bacillus perfringens" (Veillon and Zuber), has begun to appear in France in the last two years, but without evidence of acquaintance with the American publications. Even allowing for the great difficulties in keeping pace with the literature of any subject in medicine, a decade would certainly seem sufficient for the light to penetrate even into dark places.

capsulatus," as being the first one applied, should be preferred to that of Bacillus phlegmones emphysematosae. It is, moreover, as pointed out by Muscatello, not open to objection of implying exclusive relationship to a single disease, as is the case with Fraenkel's designation of the bacillus. As a matter of fact, as we shall see, the capacity to produce gaseous phlegmons is only one of many pathogenic manifestations of Bacillus aerogenes capsulatus. Unfortunately I think that we both erred against the canons of botanical nomenclature in using a trinomial rather than a binomial name for a species 13

Characters of Bacillus —Since our first publication only one material addition has been made to the extended description given by Welch and Nuttall of the morphological and cultural characters of Bacillus aerogenes capsulatus or the gas-bacillus as I shall briefly call it ¹⁴ Fraenkel noted the presence of spores in a few of the bacilli growing in one lot of agar containing sodium formate, and in 1897 Dunham¹⁵ observed spores, with all of the specimens studied, in blood-serum cultures, but not in other media

Our further studies of the gas-bacillus obtained from different sources have shown a moderate range of variation in some of its properties. This is true especially of spore-formation, rapidity of liquefaction of gelatine, presence of capsules and virulence

(p 187) When some specimens of the bacillus never seem to form spores on any culture-medium, others, and these appear to

¹³ Migula, who, with considerable success, has attempted to reform bacteriological nomenclature, has given the binomial names "Bacterium Welchii" to Bacillus aerogenes capsulatus and "Bacterium emphysematosum" to Bacillus phlegmones emphysematosae (System der Bakterien, II, pp 392 and 383, Jena, 1900) He is, however, in error in describing this organism under two different names, as his Bacterium Welchii and Bacterium emphysematosum are identical

As regards these characters it will suffice here to say that the microorganism is a rather coarse, non-motile, anaerobic bacillus, stains by Gram, grows on all of the ordinary culture-media under anaerobic conditions, best at body temperature, but also at room temperature, liquefies gelatine slowly, forms spores constantly according to the race and the culture-medium, and is capable of generating gas not only by fermentation of sugars but also from proteids The full description of the characters may be found in Welch and Nuttall's paper

¹⁶ Bulletin of the Johns Hopkins Hospital, 1897, VIII, p 68

be the more common, do so occasionally, especially upon bloodserum, in mannite bouillon, and on plain agar. In animals inoculated with pure cultures we have not observed spore-bearing bacilli.

As a rule the bacillus liquefies gelatine slowly but some specimens do so scarcely at all, and others with fair rapidity. In our first communication we noted peptonization and softening of the gelatine, but this was so slow and slight with the particular specimen studied that we then preferred to class the bacillus among the non-liquefiers. Further experience has shown that the bacillus is a liquefier, but generally a slow one.

As stated in our original article, capsules are not constantly present, but I have generally found no difficulty in demonstrating them in the situations and by the method described by us, and, with the exception of Hitschmann and Lindenthal, most other investigators have been able to demonstrate capsules, when these are searched for by suitable methods

While the bacillus is to be ranked among those which stain by Gram, it is sometimes rather noticeable in coverslips from cultures that among well stained bacilli, others are partly or wholly decolorized, and this may be observed in members of a single chain. In the tissues the bacilli stain well by Gram. Differences in the viability of cultures were pointed out in our first paper.

It sometimes happens that original cultures from human beings show only a feeble growth, with relatively weak power of gasproduction, while subsequent cultures, especially those obtained after passage through the animal body, present the usual vigorous growth and other typical characters Pratt and Fulton, from a typical case of foamy organs with gas throughout the body, were unable to cultivate the bacillus at all, although twelve anaerobic culture tubes containing various media were inoculated from different parts of the body. This negative result they attribute to the fact that the body had lain in a cold storage vault for sixteen hours after death, an explanation which has some support in an observation previously reported by Welch and Flexner, but

¹⁶ Boston Med and Surg Journ, June 7, 1900, p 599

still seems hardly satisfactory, as under like conditions the bacillus has been often cultivated

Lactose, glucose and saccharose are all fermented by the gas-bacillus, the first with the largest production of gas and the last with the smallest. The gas, according to Dunham's analyses, is composed approximately of 64 per cent hydrogen, 28 per cent carbon dioxide, and 8 per cent of a residual gas believed to be mainly nitrogen. It has no foul odor. The amount of hydrogen always greatly predominates over that of carbon dioxide. There is apparently no fermentation of mannite, at least the gas is not appreciably more than in sugar-free media

E Fraenkel in 1893 was the first to demonstrate the etiological relation of the gas-bacillus to gaseous phlegmons, our previous investigations being concerned mainly with the so-called foamy organs (Schaumorgane) and the presence of gas in the blood, our results being confirmed a year later by P Ernst Soon after Fraenkel's publication we were able to confirm his discovery of the causation of gaseous phlegmons by Bacillus aerogenes capsulatus, and to repeat with like results his animal experiments

Material or cultures fresh from the infected body are usually highly virulent for guinea-pigs, pigeons and sparrows (E. Fraenkel), which succumb to rapidly spreading local necrosis of the tissues with abundant development of gas, the bacilli invading the blood during life only in small numbers or not at all. There is more or less bloody edema, but otherwise little inflammatory reaction, leukocytes being present usually only in small numbers in the exudate Rabbits and mice, while not wholly immune, are far less susceptible than guinea-pigs and pigeons Dr Lanier in my laboratory in 1896 succeeded in producing typical gaseous phlegmons around the fractured bones of rabbits inoculated intravenously with pure cultures, and Muscatello has obtained the same results. There are considerable differences in the degree of virulence of the bacillus even in fresh cultures, and old ones may be of very slight virulence.

One of the most interesting and valuable tests of the gas-bacillus is its power of producing gas abundantly in the blood, organs and tissues of rabbits killed a few minutes after intra-

venous injection, a power not possessed by colon bacilli. The differential value of this test is as great as that of cultures in fermentation tubes. The blood and tissues of the dead rabbit make the culture-medium, the body of the animal takes the place of the test tube, the inoculation is an aseptic one, the bacteria are spread by the blood-current and the conditions are anaerobic. This procedure, which was introduced by Nuttall and myself and has been fully described by us, we have found useful under proper precautions in isolating the gas-bacillus, in separating it from other bacteria which may resemble it, and in the demonstration of one of its most fundamental characteristics, namely, the power to produce gas from proteid material.

Among the points distinguishing the bacillus of malignant edema from Bacillus aerogenes capsulatus may be mentioned the following: The malignant edema bacillus is somewhat thinner; has greater tendency to grow into filaments, is less readily stained by Gram, produces spores regularly in culture-media, is motile, liquefies gelatine much more rapidly, produces a foul odor, generates less gas in lactose bouillon, clots and then peptonizes casein, generates little or no gas in rabbits inoculated intravenously and then killed, and by subcutaneous inoculation in susceptible animals causes spreading bloody edema with little or no development of gas-bubbles, and appears after death in filaments on serous surfaces

The bacillus to which Lindenthal¹⁷ has quite unnecessarily given the name Bacillus emphysematis vaginae is doubtless identical with Bacillus aerogenes capsulatus. The same is (p 188) true of Veillon and Zuber's¹⁸ Bacillus perfringens found by them in appendicitis, by Guillemot¹⁹ in gaseous gangrene and by Soupault and Guillemot²⁰ in gaseous abscesses, and of Buday's²¹ Bacillus cadaveris butyricus, and Cesaris-Demel's²¹⁸ bacillus, both found in foamy organs. I am strongly inclined to the

¹⁷ Wiener klin Wochensch, 1897, p 3, et seq.

¹⁸ Arch de med exp, 1898, X, p 539

¹⁰ Compt rend Soc de biol, 1898, 10 s, V, p 1017

²⁰ Bull et mem Soc med d hop de Paris, 1900, 3 S, XVII, p 216

²¹ Centralbl f Bakt, 1898, XXIV, p 369

²¹a Giornale d R Accad di med di Torino, 1898, LXI, p 256 and LXII, p 190

opinion that the anaerobic bacillus isolated by Achalme and others from the blood and tissues of several cases of acute articular rheumatism and found by Savtchenko and Mielkich in the soil is likewise identical with our gas-bacillus ²² As will be considered later, Gwyn has cultivated Bacillus aerogenes capsulatus also from the blood of a choreic patient during life

Distribution — The surmise expressed by Welch and Nuttall that the gas-bacillus is widely distributed in nature has since been confirmed. The natural habitat of the organism is the intestinal canal and the soil, the homes of so many other anaerobic bacteria. Welch and Flexner in 1896 brought evidence of the presence of the bacillus in both of the situations mentioned Clopton of the Johns Hopkins Hospital has found the bacillus twice in the normal appendix vermiformis Howard²³ has recently reported the presence of morphologically identical bacilli in the intestines of twenty-five consecutive human cases examined post-mortem, and in ten of these he demonstrated the bacillus by cultures and inoculation of animals The same conclusions concerning the regular presence of the bacillus in the intestine has been reached by Hitschmann and Lindenthal The gas-bacillus has been repeatedly cultivated from the intestine in my laboratory, but we have made no systematic study of the frequency of its presence 23a I have found the bacillus also in the intestines of rabbits, dogs and swine, and here it is interesting to note the frequency with which submucous gaseous blebs are found in the pig's intestine at autopsy

In 1896 Dr Walker, at the Johns Hopkins Hospital, succeeded in finding Bacillus aerogenes capsulatus in dust collected by sweeping floors, proving its presence both by cultures and animal

²² Achalme, Ann de l'Inst Pasteur, 1897, XI, p 845, Pic and Lesicur, Journ de phys et de path gen, 1899, I, p 1007, and Savtchenko and Mielkich, Arch russes de path, 1899, VIII, p 145

²³ Contributions to the Science of Medicine dedicated by his pupils to William Henry Welch on the 25th Anniversary of his doctorate, p 461, Baltimore, 1900

²³a Mr Hirshberg is now engaged in my laboratory in a study of the distribution of the gas-bacillus in human and animal intestines and in the outer world and will report his observations later

experiments. My assistant, Dr. Harris, has cultivated the bacillus from the contents of an old cesspool. I had previously reported in 1896 the isolation of the bacillus from a bullet removed from the head of the tibia in a case of gaseous phlegmon, and E Fraenkel²⁴ has cultivated the gas-bacillus from a splinter of wood extracted from a wound in a case of tetanus. These observations confirm the natural inference to be drawn from the study of cases of traumatic emphysematous gangrene, in most of which the source of infection is manifestly foreign material, especially dirt, in wounds. In the light of these demonstrations of the wide distribution of the gas-bacillus in the outer world and in feces, the conclusion is warranted that it must occasionally be present upon the human skin

We are not informed whether there are differences in the regional distribution of the gas-bacillus. The fact that during the last decade a larger number of cases of emphysematous gangrene have been reported from Baltimore than from any other single locality is due probably to our interest in the subject and consequent search for cases. The bacillus has been found not only in America and Europe, but Dr. Flexner has brought reports of three infections with the gas-bacillus in Manila observed during a stay of three months.

GAS-BUBBLES IN THE BLOOD AND ORGANS

We turn now to the consideration of the various conditions in which Bacillus aerogenes capsulatus has been found in human beings. We need not pause to consider the occasional presence of this bacillus in ordinary cadaveric decomposition, a circumstance sufficiently explicable by the occurrence of this organism in the healthy intestinal canal

Of an entirely different nature are the cases in which gasbubbles are found in the blood and organs within a few hours after death and without any trace of ordinary putrefaction. Such a condition has been recognized at autopsies as soon as one, two, three, five, eight hours after death. It may occur not only after death from gaseous phlegmon, when, however, it is by no means constant, but also after death from the most varied causes. It has been observed repeatedly in autopsies on pregnant and puerperal women, especially after death from abortion and acute sepsis. Cases reported by Cless, Iurgensen, Vachetta, Vachetta, Dunin, Vogel and others as examples of entrance of air or gas into the circulation from gastric ulcers, typhoid or dysenteric ulcers, pulmonary tuberculosis, in septicemia and various other diseases, find now their natural explanation in the invasion of gasbacilli, instead of in the curious hypotheses propounded by the authors cited. In all probability, although I have had no opportunity to observe such a case, the free gas which has been repeatedly found in (p. 189) the blood-vessels and heart after deaths from chloroform is due likewise to the invasion of the gasbacillus, and is not, as supposed by Hankel, nitrogen derived from air pressed through the lungs into the pulmonary blood-vessels in violent expiratory movements with closed glottis.

There is every gradation from cases with a few bubbles of gas in the blood or tissues to those with extensive emphysema of the organs and tissues. The term "foamy organs" (Schaumorgane of the Germans) may be applied to the latter condition. The liver is the organ most frequently the seat of early and abundant development of gas, but there is no definite rule as to the distribution and amount of gas in different cases. The gas may be limited to the abdominal veins or to the pulmonary vessels or to one of the cardiac cavities, or be found only in the tissues at one place, especially near the stomach or intestine. It is more abundant in the veins than the arteries, and may be only in the former. As will be explained later, the invasion in the majority of cases is from the intestine. That the gas-bubbles may be dislocated from their original position in liquid and soft material in the body is self-evident, but I have not found them unassociated with gas-bacilli

Formerly this early presence of free gas in the heart and vessels,

²⁵ Luft 1m Blute, Stuttgart, 1854

²⁶ Deutsches Arch f klin Med , 1882, XXXI, p 441, and 1887, XLI, p 569

²⁷ Sull' embolismo gazoso per penetrazione d'aria nel sistema circolatoria, Pisa, 1880

²⁸ Berliner Klin Woch , 1882, p 11

²⁹ Ibid , 1882, p 187

without evident post-mortem decomposition, was very generally explained by the assumption of entrance of air into the circulation, even when no portal of entry could be found.³¹ The most extensive application of this explanation was made in the pregnant and puerperal cases. It is remarkable that the first case of this nature to be examined bacteriologically was that reported by me in 1891. In this and in nearly all subsequent similar cases with satisfactory bacteriological examination Bacillus aerogenes capsulatus was found

The main questions which arise concerning the interpretation of these cases are whether the invasion of the bacilli and whether the development of the gas are ante-mortem or post-mortem phenomena.

Rabbits survive the introduction of large numbers of gasbacilli directly into the circulation, unless there exists somewhere in the body necrotic or damaged tissue offering little or no vital resistance. If the animal be killed within a few minutes after the intravenous injection of the bacilli and kept in a warm place, there are abundant multiplication of the bacilli and large development of gas throughout the body within the space of six or eight hours, whereas if the bacilli be introduced at one point, as for example the right heart, of a rabbit just killed, it takes a much longer time, often twenty-four to forty-eight hours, for gas and bacilli to make their appearance at points far distant from the seat of moculation It seems justifiable to draw from these three groups of experiments, which have been fully reported by Welch and Nuttall, the conclusion that when bacilli and gas are found within a few hours after death widely distributed in the body, the gas-bacilli have entered the circulation during life, but probably in most cases only shortly before death.

There is one factor, however, to be considered which is absent in the experimental cases and may be present in human beings, to wit, the quick disappearance of the bactericidal power of the blood. This factor is an important determinant of the rapidity of onset of post-mortem decomposition. Very soon after death from certain diseases, and particularly from snake-venom, bacteria may make their appearance in the blood and organs. An explanation of these cases is furnished by the experiments of Ewing and myself,³² which demonstrated that the blood of rabbits killed by rattlesnake venom is practically devoid of bactericidal power, so that immediately after or even shortly before death bacteria can start growing in the body as they would in a tube of beef-broth. But after all due allowance has been made for the possible reduction or loss of bactericidal power of the blood, I still consider that it is not possible to explain some of the cases in which bacilli and gas have been found in the heart, blood-vessels and organs very soon after death, especially when the corpse has been kept in a cold place, otherwise than upon the assumption of the distribution of the bacilli by the circulating blood

It is another question whether gas as well as bacilli may be present in the circulating blood and internal organs during life in the class of cases now under consideration, and I regret to be unable to furnish a positive answer to this question see how an affirmative answer can be obtained otherwise than by the actual demonstration of gas in these situations either during life or immediately after death Gas-bubbles and bacilli have been found in the heart and vessels within an hour after death, but that is time enough for bacilli which have already been introduced to multiply and begin to form gas I at first thought that absence of nuclear staining around the gas-bubbles and masses of bacilli might serve as an indication of their presence during life, and this view is advocated by P Ernst, but I have since learned from experiments on rabbits that this is not a decisive criterion, although often both in rabbits and in human beings there is no defect in nuclear staining around bacilli and gas-bubbles

I know of no other pathogenic microorganism which offers such difficulties in determining whether its effects in the interior of the body have been produced before or after death. The difficulty arises from the circumstances that these effects in most cases and most situations consist almost entirely in local necrosis

E Lancet, 1894, I, p 1236

and formation of gas, whether the invasion and growth of the bacilli be before or after death, and that unlike most pathogenic bacteria the gas-bacillus grows better in the dead than the living body. Possibly some importance in the solution of the problem may attach to the demonstration of emboli of liver cells and of bone-marrow cells which were in enormous numbers in the pulmonary vessels in a case of gaseous phlegmon of the submammary tissues following infusion of salt-solution. At the autopsy made by Dr. Carroll (p. 190) the liver and other organs were emphysematous. Further observations with reference to these emboli in this class of cases are needed.

I do not consider that there is any inherent improbability in the supposition that gas-bubbles may be in the circulating blood during life without causing speedy death from gaseous embolism. It is only when a large volume of air is introduced quickly into the blood-current that sudden death results from air-embolism. Very exaggerated ideas have prevailed among physicians as to the dangers from the entrance into the circulation of small quantities of air. Laborde and Muron³³ injected into the external jugular vein of a dog 1120 cc. of air in the space of one hour and a half without causing death, and Jurgensen,34 into the left femoral artery of a narcotized dog weighing 43½ kilo, 3650 cc. in the space of two hours and twenty-five minutes with only slight disturbance of the respiration and of the action of the heart. Hare, 35 on the basis of experiments, likewise controverts current beliefs concerning the dangers from entrance of a moderate quantity of air into the veins

I have come across in the older literature from the days when venesection was a common practice, reports of cases in which blood containing bubbles of gas escaped during venesection from vens of the arm ³⁶ In none of these was there evidence that air

²³ Comptes rend Soc de la biol, 1873, V

³⁴ Deutsches Arch f kl Med, 1882, XXXI, p 458

³⁵ Therap Gazette, 1889, 3 S, V, p 606

³⁶ Marshall's case reported by May, Trans Path Soc, London, 1858, IX, p 157, Durand-Fardel's case also cited by May, and Pirogoff's case in his Grundzuge d allgem Kriegschirurgie, p 1063, Leipzig, 1864

had gained entrance to the circulation Maisonneuve,³⁷ in incising two gaseous phlegmons of the thigh following compound fracture, observed the escape of blood containing gas-bubbles from the cut veins and was able to trace the gas within the veins for a long distance

It seems to me very improbable that an anaerobic bacillus, such as the gas-bacillus, can multiply in the circulating blood, still this bacillus is less sensitive to the presence of oxygen than many anaerobes, and we do not know whether the loose combination in which oxygen is present in the blood would necessarily prevent its growth under all circumstances

I see no reason why this bacillus might not multiply and form gas in the liver, spleen and most other internal organs, as we know it can do in parts open to inspection during life. We have positive evidence in the cases reported by Graham, Steward and Baldwin and by Dunham that gas-bacilli may be conveyed by the circulation from an infected portal of entry-in the one case the puerperal uterus and in the other a urethral wound—to distant parts of the body and there produce subcutaneous emphysema and necrosis There is no part of the body which offers such favorable conditions for the postmortem growth of the bacıllus as the liver, probably on account of its content of carbohydrate, and, if the liver like the integuments were open to inspection during life, I believe that we should find evidence that in certain cases the emphysema of this organ, which is such a conspicuous postmortem phenomenon in instances of invasion by the gas-bacillus, had begun during the life of the patient. As will be considered subsequently emphysema of mucous membranes open to inspection, we know can exist during life

In the great majority of the instances, however, in which gasbubbles are found in the blood and internal organs at autopsy the evidence is in support of the view that the development of the gas is purely post-mortem phenomenon. Certainly the greatest caution should be exercised in the interpretation of any

³⁷ Cited from Hitschmann and Lindenthal, Situngsb d k Akad d Wiss, Math-Naturw Cl, Wien, 1899, CVIII, 111, 3, p 67

such cases as vital processes, even in early autopsies without ordinary putrefaction. One thing which our investigations have established is that the finding of gas-bubbles in the blood-vessels and heart within so short a time as one hour after death furnishes in itself no proof of the entrance of air into the circulation. Especially is it to be emphasized that the limitation of gas to the right heart and adjacent vessels may occur in cases of invasion by the gas-bacillus and is not, as is often represented, peculiar to air-embolism. I shall refer later to the question of gaseous embolism in cases of emphysematous gangrene and of physometra.

EMPHYSEMATOUS GANGRENE

In a few instances we have found in wounds, usually compound fractures or gunshot injuries, in which dirt had gotten in, Bacillus aerogenes capsulatus without the presence of gas or other evidence that the bacillus was producing any characteristic effects 38 Such cases have always been watched by the surgeons with anxiety, and it is probable that at least in some the early recognition of the bacillus followed by free incisions and thorough cleansing and disinfection has warded off a subsequent grave In view of the wide distribution of the gas-bacillus in the outer world and in the intestinal contents it is probable that it must not so very infrequently gain access to wounds without securing a foothold While this innocent behavior, with which we are also familiar in the case of the tetanus bacillus, may sometimes be due to attenuated virulence of the bacillus, it is probably oftener attributable to accessory circumstances, such as the resistance of the patient, the condition of the wound and surrounding tissues, and lack of association with suitable microorganisms and foreign substances

It is as a cause of that most dreaded of wound complications, emphysematous gangrene, that Bacillus aerogenes capsulatus especially claims the interest of surgeons. The classical clinical descriptions of this disease we owe to Maisonneuve³⁹ and Piro-

³⁸ Such cases have been reported by Bloodgood from the Johns Hopkins Hospital in Progressive Medicine, 1899, IV, December, p. 158

³⁹ Gaz med de Paris, 1853, P 592

goff,40 the former giving to it the name (p 191) "gangrène foudroyante," and the latter designating it "primary mephitic gangrene" or "acute gangrenous edema". Among other more or less common designations are "emphysematous or gaseous gangrene," "gaseous phlegmon," "septic emphysema," "érysipèle bronzé" (Velpeau), "progressive gangrenous edema," "gangrenous septicaemia," and "emphysematous cellulitis"

This wound complication was more common in preantiseptic times, especially in military surgery, than it is today, but at least 70 cases have been reported during the last quarter of a century. In prebacterial days the affection was attributed by some writers to the penetration of air into the tissues, but by most to the decomposition of the tissues, particularly of adipose tissue and bone-marrow, brought by an injury into contact with the atmosphere

Bottini⁴¹ in 1871 was the first to demonstrate the infective nature and transmissibility of emphysematous gangrene

Later Gussenbauer⁴² also recognized the disease as a definite infection and attributed it to the bacteria of putrefaction. After Pasteur's discovery in 1877 of his "vibrion septique," more commonly, since Koch and Gaffky's investigations, designated Bacillus edematis maligni, and especially after Chauveau and Arloing's⁴² paper in 1884, cases of emphysematous gangrene have been usually reported, especially in France, as instances of Pasteur's gangrenous septicaemia or Koch's malignant edema W Koch's⁴⁴ attempt to identify the disease with symptomatic anthrax (Rauschbrand) was based on faulty bacteriological studies and has met with no confirmation. In 1884 F. J. Rosenbach⁴⁵ reported finding in coverslip specimens from two cases of traumatic emphysematous gangrene coarse bacilli, some of which had terminal spores. These he was unable to cultivate, only aerobic methods being employed. It is probable that Rosen-

⁴⁰ Grundzuge d allgem Kriegschirurgie, pp 867 and 1006, Leipzig, 1864

⁴¹ Gior d r Accad di med di Torino, 1871, 3 S, X, pp 1121 and 1138

⁴² Deutsche Chirurgie, Lief 4, Stuttgart, 1882 ⁴³ Bull Acad de Med, 1884, 2 S, XIII, p 604 ⁴⁴ Deutsche Chirurgie, Lief 9, Stuttgart, 1886

⁴⁵ Die Mikroorganismen bei den Wund-Infections-Krankheiten des Menschen, Wiesbaden, 1884

bach saw Bacillus aerogenes capsulatus in these cases, but without distinguishing it from associated spore-bearing bacilli. A critical examination of the records of alleged malignant edema in human beings shows that in very few was the organism concerned satisfactorily identified as the genuine malignant edema bacıllus Very often 1t has been sımply assumed without more than a microscopical examination that bacilli found in spreading edematous conditions with or without gas have been those of malignant edema, and even where cultures and animal experiments have been employed the descriptions are frequently so meagre as to leave the identity of the organism wholly in In France it is usually assumed without any discussion and even without any bacteriological examination that gangrène foudroyante is malignant edema (Pasteur's septicaemia),46 and the same ignorance of the present status of this subject is still sometimes encountered in England, Germany and elsewhere. Nevertheless the investigations of the last seven years, beginning with those of E Fraenkel and soon followed by observations of myself and collaborators, have demonstrated that by far the most common and important specific cause of gaseous phlegmons or emphysematous gangrene is Bacillus aerogenes capsulatus

Whether the bacillus of malignant edema can produce an identical or similar anatomical and clinical affection in human beings I regard as an unsettled question It is certainly remarkable in view of current doctrines in text-books that neither E Fraenkel nor I, with our relatively large experience, nor indeed, so far as I am aware, any one who has made himself thoroughly acquainted with Bacillus aerogenes capsulatus, has encountered an instance of emphysematous gangrene in man caused by the bacillus malig-The whole subject of human malignant edema is one which needs thorough revision and investigation by more exact bacteriological methods than have yet been applied to it 47

⁴⁶ An exception is Guillemot (Compt rend Soc de biol, 1898, 10 S, V, p 1017) who has found B aerog caps (B perfringens) in a case of gaseous gangrene and who controverts the prevalent view of French authors who attribute this disease exclusively to Pasteur's vibrio

⁴⁷ In the case reported recently by Brabec (Wiener klin Rundschau, 1900, XIV, pp 145 and 167) the identification of the malignant edema bacillus seems satisfactory Here

I have already mentioned the chief points of difference between the bacillus of malignant edema and Bacillus aerogenes capsulatus

There is a relatively small group of cases of gaseous phlegmon attributed by those reporting them⁴⁸ either to the colon bacillus or the proteus bacillus. In most of these cases anaerobic culture methods were not employed. No one has succeeded in producing experimentally gaseous phlegmon with either of these bacilli, and I think there is good reason to be skeptical concerning their capacity to produce this disease, unless perhaps Bacillus coli may do so in diabetics

It is possible that some of those reporting the colon bacillus as the cause of emphysematous gangrene may have confounded with it a facultative anaerobic bacillus which we have isolated from two cases of this disease, and which has been studied in my laboratory by Dr. Lanier. It resembles in anaerobic cultures very closely Bacillus aerogenes capsulatus, but it is capable of aerobic growth also, and then the rods are thinner and more like colon bacilli It has the power of producing gas abundantly in the blood and tissues of rabbits killed a few minutes after intravenous injection, a power not possessed by genuine colon I have already spoken of (p 192) the importance of this test, which has been employed by none of the writers who have claimed to find colon bacilli as the cause of gaseous phlegmons This bacillus, when virulent, is capable of causing the same spreading and fatal emphysematous necrosis in guinea-pigs and pigeons as is Bacillus aerogenes capsulatus

I have been accustomed to speak of this bacillus, to which I have called attention in previous publications, as the aerobic variety of our gas-bacillus I believe, however, that it is identical with Sanfelice's Bacillus pseudo-edematis maligni, 49 with which

there was extensive bloody edema without gas, so that the case was not one of emphysematous gangrene. On the other hand, Hamig and Silberschmidt (Correspondenzbl f Schweizer Aerzte, 1900, XXX, p 361) bring no proof of any consequence that they were dealing, as they supposed, with the malignant edema bacillus in two cases of gangrene foudroyante

⁴⁸ Chiari, v Dungern, Bunge, Klemm, Hlava, Evans, Grasberger, Hauser, Margarucci, Muscatello, Hitschmann and Lindenthal

⁴⁹ Ann d Istit d'Igiene sper d Univ di Roma, 1891, N S, I, p 365, and Ztschr f Hyg, 1893, XIV, p 352

he is inclined to identify Klein's "new bacillus of malignant edema" Chavigny has isolated apparently the same bacillus, which he likewise identifies with Sanfelice's Bacillus pseudoedematis maligni (not to be confounded with the pseudoedema bacillus of Liborious), from a case of gaseous gangrene, and he also calls attention to the probability that others may have mistaken it for the colon bacillus. While, therefore, unwilling upon existing evidence to accept the colon bacillus as a demonstrated cause of gaseous gangrene (except perhaps in diabetics), I am of the opinion that an aerobic bacillus, probably identical with Sanfelice's Bacillus pseudo-edematis maligni, is capable of producing this affection, but it is much less frequently concerned than Bacillus aerogenes capsulatus.

I have collected 46 cases of emphysematous gangrene, in all of which Bacillus aerogenes capsulatus was demonstrated, and, therefore, all reported or observed during the last seven years 52

50 Centralbl f Bakter, 1891, X, p 186

⁵¹ Ann d l'Inst Pasteur, 1897, XI, p 860 Perhaps the bacillus found by Foa and Bonome (Ztschr f Hyg, 1889, V, p 403) in a case of anthrax-like septicaemia with gas in the tissues was Sanfelice's bacillus Roncali in the Italian translation of Senn's Surgical Bacteriology (Bacteriologia Chirurgica, p 109) also claims Sanfelice's bacillus as a cause

of gaseous gangrene

52 This list includes 16 cases observed in Baltimore, mostly at the Johns Hopkins Hospital, of which 2 are unpublished, and the remaining 14 have been published by Mann (1), Ann Surg, 1894, XIX, p 187, Welch and Flexner (6), Journ Exp Med, 1896, I, p 5, Martin (1), University Bulletin, 1896, I, No 3, and Bloodgood (6), Progressive Medicine, 1899, IV, December, p 158 The notes of an additional unpublished case observed in Manila have been given me by Dr Flexner There are also 3 unpublished cases for the records of which I am indebted to Dr Carroll of Washington

The references to the remaining 26 cases are as follows E Fraenkel (4), Ueber Gasphlegmonen, Hamburg u Leipzig, 1893, Passow (1), Charite-Annalen, 1895, XX, p 275, Dunham (5), Bulletin of the Johns Hopkins Hospital, 1897, VIII, p 68, Ferguson (1), Trans Indiana Med Soc, 1897, p 339, Erdmann (1), Med Record, Feb 5, 1898, p 205, Le Boutillier (1), Med Record, March 5, 1898, p 353, Love and Cary (1), Med Record, April 8, 1899, Norris (1), Amer Journ Med Sc, 1899, CXVII, p 195, Hitschmann and Lindenthal (5), Sitzungsb d k Akad d Wiss, Math-Naturw Cl, Wien, 1899, CVIII, Hft 111, Abth 111, p 67, Thorndike (2), Boston Med and Surg Journ, June 7, 1900, p 592, Muscatello with Gangitano (3), Riforma med, 1900, II, pp 508, 519 and 530, Guillemot (1), Compt rend Soc de biol, 1898, 10 S, V, p 1017 A few other cases in which the gas-bacillus was found are not reported with sufficient detail to be available for analysis It is safe to say that B aerog caps has now been found in over 50 cases of gaseous gangrene

This is a far larger number of cases than has ever been brought together before

Thirty-two are reported by American observers and only 14 by foreign investigators. Of the former group of cases 16 were observed in Baltimore, most of the cultures having been studied in my laboratory, of the foreign group of cases all are reported from Germany, Austria, Italy and France, 4 by E. Fraenkel, I (not absolutely certain) by Passov, 5 by Hitschmann and Lindenthal, 3 by Muscatello assisted by Gangitano and I by Guillemot 53

Cases of gaseous phlegmon in which Bacillus aerogenes capsulatus was not demonstrated are not included, although many of these presented the same clinical characters and doubtless in some at least the gas-bacillus was the active agent. This is true especially of the cases of gangrène foudroyante, usually without satisfactory bacteriological examination, attributed by French writers to Pasteur's vibrion septique. Gertler's eight cases of gaseous phlegmon cannot be utilized for our purposes at all, as they are without any satisfactory bacteriological reports.

A complete analysis of these 46 cases would afford material more than sufficient to occupy this entire address, so that I shall be able to present here only some of he more important points

Thirty-five of the patients were males, 10 females and of one the sex is not stated. The preponderance of males is to be explained by the fact that most of the cases were due to severe injuries. Robust workmen in the prime of life furnished the largest contingent of cases

In 80 per cent of the cases one of the extremities was the seat of the emphysematous gangrene, the lower being affected a little over twice as often as the upper extremities. In several instances the emphysema extended from the thigh to the abdominal

ES Soupault and Guillemot (Bull et mem Soc med d hop de Paris, 1900, 3 S, XVII, p 216) have reported two gaseous abscesses following hypodermic injections, and a third which they regard as metastatic, in which they found the gas-bacillus (B perifringens), once in pure culture These cases will be considered subsequently under the heading "Gaseous Abscesses"

⁵⁴ Ueber Gasphlegmonen Inaug -Diss Halle, 1898

wall or from the arm to the subcutaneous tissues of the shoulder and chest There were three examples of primary emphyse-matous phlegmon of the abdominal wall. of these one following removal of the appendix (Bloodgood), one from an unrecognized strangulated Littré hernia (Martin), and one affecting the deep tissues of a nephrectomy wound (Muscatello) In all of these the infection is believed to have started from the intestine. In one of Dunham's cases there was emphysematous gangrene (originating in a prostatic abscess opening in the buttock) of the scrotum, penis, and anterior abdominal and thoracic subcutaneous tissues. In three instances (Carroll (2), Dobbin (1) reported by Bloodgood) the breast and submammary tissues were the primary (p. 193) seat of the disease, all of these resulting from the infusion of salt solution. In one case (Dunham) the gaseous phlegmon appeared at the angle of the lower jaw after incision of a foul submaxillary abscess In one instance (Welch and Flexner) it started within the pelvis from traumatic rupture of the rectum and extended through the sciatic notch down the thigh

Of especial interest are three examples of multiple or metastatic emphysematous gangrene, one of the forearm and opposite shoulder, another of the thigh and both shoulders, and still another of one shoulder and the buttocks. In the older literature are similar cases, thus Nélaton observed emphysema not only in the injured leg but also in the opposite, uninjured extremity. In 1897 Leech⁵⁵ reported without adequate bacteriological examination a case of emphysematous gangrene of the right leg following about three weeks after injury of the right thumb, which became inflamed, there being no evident local cause of the affection of the leg. These cases are to be explained by transportation of the bacilli through the lymphatic or blood-current from the primary focus of entrance

In all but 5 of the 46 cases the emphysematous gangrene followed traumatism or a surgical operation. The injuries were as follows. compound fractures, 18, bullet and gunshot wounds, 7, infusion of salt solution, 3, hypodermic injections, 2, ligation

of the femoral artery for aneurysm, 3, external urethrotomy, 2, traumatic rupture of the rectum, removal of the appendix, prostatic abscess following self-catheterization, operation for strangulated, Littré hernia, incision of a foul submaxillary abscess, and nephrectomy, each 1. Of the 5 non-traumatic cases the gaseous gangrene followed erysipelas in one, was consecutive to apparently spontaneous gangrene in 2, whether diabetic or not is not stated, and was without apparent explanation in two (Fraenkel's Case 2 and Passow).

Compound fractures and next bullet and gunshot wounds occupy by far the most prominent place in this list, each of the other various causes being represented only by scattered cases. Those injuries in which there are much laceration and crushing of tissue, comminution of bone and grinding of dirt, bits of clothing or other foreign bodies into the wound are the ones most likely to be followed by emphsematous gangrene. That, however, severe traumatism is not an essential factor is shown by the 5 cases (10.9 per cent of the entire number) following hypodermic injections and infusion of normal salt solution (see cases also under "Gaseous Abscesses"). These latter, however, were all of patients whose vital forces were greatly depressed, namely, by Asiatic cholera, typhoid fever, surgical shock, or post-partum haemorrhage. There is good reason to believe that the intact tissues of human beings in health possess marked resistance to the gas-bacillus.

In the great majority of cases it was evident that the gas-bacillus was introduced through the wounded skin from without In three instances (removal of appendix, strangulated hernia, and traumatic rupture of the rectum) the infection undoubtedly came from the intestine. This was also the probable source of infection in one of Muscatello's cases (gaseous phlegmon in the site of an extirpated kidney). With our present knowledge of the frequent, if not regular, presence of Bacillus aerogenes capsulatus in the intestine, there is nothing surprising in this mode of infection. In three of Dunham's cases the infection followed injury of the urethra, and here also the bacilli may have come primarily from the intestine. In one of his cases (gaseous phlegmon

at angle of the jaw) it was suggested that the bacilli gained entrance through decayed teeth.

Bloodgood thinks it probable that in one of his cases the gasbacilli were brought by the circulation to the seat of infection. In this case the femoral artery was ligated for traumatic arteriovenous aneurysm in the popliteal space. There was no primary infection of the wound, but gangrene of the foot and leg ensued and on incision gas-bubbles were found in the blood of the aneurysmal sac and the tissues With what we know about the entrance of intestinal bacteria into the circulation, there is nothing improbable in Bloodgood's opinion, which is also supported by Lanier's and Muscatello's experiments already mentioned. The clot in an aneurysm and tissues robbed of their nutrient supply would offer little or no resistance to the growth of bacıllı which might reach them or their immediate neighborhood through the circulation and the conditions would be anaerobic. It was indeed a case of aneurysm in which I first found the gas-bacillus, and here the clot was swarming with bacilli. It is interesting to note that three of the cases of emphysematous gangrene in my list followed ligation of the femoral or popliteal artery for aneurysm.

Pirogoff⁶⁶ distinguished clinically two groups of cases of traumatic emphysematous gangrene. He described under the name "primary mephitic gangrene" cases in which the emphysema appears within two days after the injury, the "local stupor" passing without inflammatory reaction into crepitating gangrene. Here the emphysematous necrosis spreads rapidly, the patient sinks into collapse with an icteroid hue of the skin, small, thready pulse and cold sweats, and death occurs usually within a few days after the onset. This type of the disease corresponds to Maisonneuve's gangrène foudroyante. In the second group, designated by Pirogoff also as "acute gangrenous edema," there is reaction from the primary "local stupor" of the tissues, the emphysema is preceded and accompanied by local, edematous or purulent inflammation, is associated with febrile reaction, often appears later after the injury and spreads less rapidly, and presents in

⁶⁶ Grundzuge d. allg Kriegschirurgie, p. 1006, Leipzig, 1864.

general a more varied anatomical and clinical picture than the first class of cases

Hitschmann and Lindenthal consider that Pirogoff's first group corresponds especially to cases of pure or predominant infection with the gas-bacillus, and his second group to mixed infections Erdmann is also of the opinion that in the unmixed (p 194) infections the emphysematous necrosis spreads more rapidly and is more likely to terminate fatally. On the other hand, Muscatello and Gangitano, who also divide the cases into two groups—pure infections and mixed infections—hold that the mixed infections are characterized by the rapidly progressive form of emphysematous gangrene, while the pure infections, at least in their early stage, show little tendency to spread beyond the injured tissues According to the last named authors the gas-bacillus is incapable of exerting any pathogenic action upon healthy tissues, but attacks only tissues already altered in their vitality by injury, other pathogenic mircoorganisms, toxins, or other depressing factors

The study of our cases has not enabled me to adopt in their exclusive form either of the two conflicting opinions just stated Of the collected 46 cases, 30 were mixed infections, 14 were pure and of 2 there is no clear statement on this point. The most common associated bacteria were the pyogenic streptococci and staphylococci Among other forms found occasionally were Bacillus coli, proteus, pyocyaneus, tetanus, Sanfelice's Bacillus pseudo-edematis maligni, and uncultivable, often sporebearing, It seems probable that the bacillus of malignant edema, being a common inhabitant of the soil, must occasionally, like the tetanus bacillus, be present, but it was not isolated from any of My experience is that if reliance be not placed exclusively upon cultures, but careful microscopical examinations be also made, instances of unmixed infection with Bacillus aerogenes capsulatus are rare It is by no means always easy to determine whether associated bacteria are exerting pathogenic action or not Pyogeniccocci may be present without producing pus or marked inflammatory reaction

We have found rapidly progressive forms of emphysematous gangrene both with pure infection with the gas-bacillus and with

mixed infections, and on the other hand we have observed with both types of infection cases in which the tendency to spread is much less marked. In all of the cases with much purulent inflammation mixed infection was present, but aside from this feature the division of the cases into pure and mixed infections does not, according to our experience, correspond to different, sharply marked, clinical features. Pirogoff's classification is doubtless of clinical value, but there is every gradation between the two groups

I cannot agree with Muscatello and Gangitano, whose investigations of emphysematous gangrene are of great value, that the gas-bacillus is incapable of attacking healthy tissues. Virulent cultures, even in moderate doses, can produce rapidly spreading gaseous phlegmons when inoculated into the subcutaneous tissues of susceptible animals such as guinea-pigs and pigeons. In human beings the emphysema may extend very rapidly into the healthy tissues, frequently outstripping in its advance the inflammatory edema. This may occur in pure, as well as in mixed, infections with the gas-bacillus. After amputation through apparently healthy tissues there may be rapidly spreading emphysema from the stump (Welch and Flexner's Case II) The two instances of meningitis observed by Hitschmann and Lindenthal and by Howard speak also for the power of the gas-bacıllus to attack healthy tissues It is true, as urged by Muscatello and Gangitano, that toxins derived from the bacilli may prepare the tissues for the invasion and action of the advancing bacilli, but the same explanation has been put forward for the spread of other pathogenic bacteria in healthy tissues. In asserting that the gas-bacillus may attack healthy tissues, I would not be understood as minimizing the great importance of the various accessory causes of emphysematous gangrene which act by lowering the vitality of the tissues or the general resistance of the patient, or as failing to recognize the marked resistance to infection by the gas-bacillus offered by the healthy tissues, a resistance to which I have previously called attention and which I shall have occasion further to emphasize.

Gas may appear in the tissues as early as eight hours after the

injury. In a case of gaseous phlegmon following a bullet wound of the knee joint, reported by Welch and Flexner, Dr. Bloodgood recognized gas in the joint⁵⁷ and surrounding tissues just twenty hours after the injury. In a case of Dr Tiffany's, which we have reported, death from emphysematous gangrene, due to pure infection with the gas-bacillus, occurred forty-eight hours after a fall causing a compound, comminuted fracture of the patella with grinding of the underclothing into the wound. There was no other injury of the body. Any one who has seen one of these rapidly fatal cases of spreading, traumatic, emphysematous gangrene will receive an impression which he will never forget.

The anatomical and clinical study of uncomplicated emphysematous gangrene demonstrates that the disease is not, as many formerly supposed, simply an intense variety of ordinary phlegmonous inflammation or cellulitis, but is a disease sui generis. It may be combined with phlegmonous inflammation, but then some other microorganism, usually the streptococcus, is associated with the gas-bacillus

In typical uncomplicated cases the lesions consist in necrosis of all the tissues, the presence of gas in the interstices, infiltration with blood, evidences of the mechanical action of the gas, and exudation of a variable amount of bloody serum. The amount of gas varies much in different cases. There may be only a few bubbles or the tissues may be everywhere blown up with gas. The nuclei disappear by karyolysis. The notable thing in most cases is a nearly complete absence of leukocytes and of cellular reaction, although in a few instances, even of pure infection, I have found leukocytes in considerable number, and even purulent foci, but generally at a distance from the primary necrosis. As will be shown later Bacillus aerogenes capsulatus in certain situations is capable of setting up purulent inflammation. In one of our cases, reported by Bloodgood, Dr. Cushing found gasbacilli without gas in a small subcutaneous abscess of a stump two

⁶⁷ It is to be regretted that in the cases reported by Prutz (Deutsche Zeitschr f Chirurg, 1898, XLVII, p 591), as traumatic entrance of air into the knee joint, no bacteriological examination was made

(p 195) months after amputation of the thigh for emphysematous gangrene of the leg, the amputation having been followed by uninterrupted convalescence.

After death there may be rapid extension of the subcutaneous emphysema, and at autopsies made a few hours after death gas-bubbles may be found in the heart, vessels, liver and other organs, but as to this occurrence there is no rule. As I have already explained wide-spread distribution of gas in the blood and organs in early autopsies indicates entrance of the bacilli into the circulation during life.

As is to be expected from the etiology of many of the cases of emphysematous gangrene, emboli of fat and of bone-marrow cells are common in the pulmonary capillaries, but I do not know that in any case they contributed to the fatal result

The prognosis of emphysematous gangrene is more favorable today than before the antiseptic period. The disease terminated fatally in 59 per cent of the cases in my list. In the cases observed and treated at the Johns Hopkins Hospital—10 in number—the fatality was 50 per cent, but of these one was a gaseous phlegmon of the abdominal wall following removal of the appendix and complicated with diffuse gangrenous peritonitis, and a third case terminated twenty-five days after disappearance of a gaseous phlegmon of the thigh (treated by incisions) from a late strepto-coccus infection, gas and the gas-bacillus having disappeared. Of the two remaining fatal cases in one—emphysematous gangrene following compound fracture of the thigh—amputation was refused by the patient until the fourth day when he was in a state of collapse and died fifteen hours later, and in the other—compound fracture of the skull and both lower extremities—the patient died thirty hours after the accident, having never regained consciousness.

When the disease is accessible to surgical treatment, is not complicated by other grave conditions, and is promptly recognized and treated, the prognosis, according to the experience of my surgical colleagues, Professor Halsted and Dr Bloodgood, is not very unfavorable

The clinical evidence favors the view that, at least in most

uncomplicated fatal cases, death is due to toxemia. Norris was unable to demonstrate the presence of strong toxins in artificial cultures of Bacillus aerogenes capsulatus, but, as is well known, the same difficulty is encountered with many other pathogenic bacteria which are believed to produce poisons in the human body. Muscatello is also of the opinion that the constitutional symptoms are attributable to toxemia.

The suggestion that death may be due to gaseous embolism is not new Pirogoff and other of the older observers knew that gas-bubbles may be found within the heart and vessels very soon after the death of patients from emphysematous gangrene. In the discussion on Langenbeck's paper on traumatic infiltration before the Society of German Military Surgeons in 1870, Senator⁵⁸ advocated the supposition that death is caused by gas-embolism. While the possibility of this occurrence as the cause of death may be admitted, there is at present no proof of this opinion Gas-bubbles are by no means always found in the blood and organs after death from emphysematous gangrene, and the clinical histories of those in whom they are found post mortem do not appear to differ from those where they are absent. In experimental gaseous phlegmons in guinea-pigs there is no evidence of the presence of gas-bubbles in the circulation during life.

In one of our cases (Mann) death resulted from tetanus and Verneuil⁵⁹ has reported three cases which without bacteriological examination he, in conformity with current French opinion, calls malignant edema, where also tetanus intervened. There is nothing surprising in this association when one considers that the home of the tetanus bacillus, like that of the gas-bacillus, is the soil. The period of incubation for tetanus is longer than for infection with the gas-bacillus, the former appearing rarely before the seventh day, and the latter usually within two or three days after the injury

Prophylactic measures against emphysematous gangrene are sufficiently obvious from the etiological factors which have already been considered. It is important in wounds of the char-

⁸ Deutsche militararztl Zeitschr, 1872, I, p 260

⁵⁹ Semaine med , 1890, p 403

acter most frequently followed by this complication to search microscopically and by cultures for Bacillus aerogenes capsulatus. The examination of coverslips, stained by Gram, will usually suffice for a probable diagnosis. I have already cited instances in which this bacillus has been detected before the onset of of emphysema and in which there is good reason to think prompt surgical treatment warded off severe infection. The possibility of infection from the intestinal canal, as well as from external sources, is to be borne in mind.

The cases were treated either by free incisions or by amputation The results were better after amputation than after simple incisions. Of the cases of emphysematous gangrene affecting primarily the extremities, the recoveries numbered 68 per cent after amputation, and 333 per cent after incision without amputation Careful study of individual cases shows that amputation is by no means always necessary Everything depends upon early recognition of the nature of the infection. Dr. Bloodgood,60 from a relatively large experience, says. "If the infection is recognized early, and the destruction of the soft parts and bone is not extensive, free incisions with immediate continuous bath treatment should be tried. If the general symptoms of infection are not immediately relieved, amputation should be done. If, however, the infection is recognized late one should take no risk but amputate at once ... An early diagnosis will probably save life, and from many observations an amputation may not always be necessary."

A similar position as to prognosis and treatment is taken by Muscatello and Gangitano in their valuable paper on gaseous (p. 196) gangrene, in which they also emphasize the value of abundant irrigations with disinfectant and oxidizing solutions. In the service of Dr. Halsted at the Johns Hopkins Hospital the continuous bath treatment has been found useful. Hitschmann and Lindenthal are certainly mistaken in their assertion that incisions are usually without favorable effect and that early amputations offer the only chance of recovery. As pointed out by Thorndike and others recovery may follow amputation even when it is impossible to remove the whole of the diseased tissues

⁶⁰ Progressive Medicine, 1899, IV, December, p 174

GASEOUS ABSCESSES

The presence of gas in closed abscesses may be due to Bacillus aerogenes capsulatus.

It seems to me questionable whether Fraenkel's61 second case should be classified under emphysematous gangrene region of the right elbow joint there was a painful fluctuating swelling from which on incision fetid pus mixed with gas-bubbles escaped. The subcutaneous tissue was partly necrotic similar swelling over the left shoulder joint was also incised. Besides the gas-bacillus, streptococci and long delicate bacilli appeared in the cultures There is no statement concerning the causation of these abscesses. Passow's case was also a peculiar one. Following a superficial, suppurating wound of the right hand there appeared panophthalmitis with septicaemia, during which a crepitating swelling of the right shoulder and upper arm developed, from which on incision were evacuated gas and a brownish, fetid secretion, but no actual pus. Besides staphylococci a bacillus, believed by Passow to be identical with the gas-bacillus, was cultivated. I have included these two cases under the gaseous phlegmons or emphysematous gangrene, although at least the former seems to have been one of definite abscesses.

Soupault and Guillemot⁶² have recorded two cases of gaseous abscess, following hypodermic injections, due to the gas-bacillus. They call the organism "Bacillus perfringens" (Veillon and Zuber), but identify it with Fraenkel's Bacillus phlegmones emphysematosae. Of the American work on Bacillus aerogenes capsulatus they have apparently never heard In Soupault and Guillemot's first case a large abscess containing fetid pus and gas with the odor of sulphuretted hydrogen followed the injection of 40 cc of 5 per cent common salt solution into the thigh of a patient with advanced and rapidly extending pulmonary tuberculosis. The injection, made September 7, was at once followed by a painful swelling of the thigh, over which the skin was reddened; on September 15, gas was detected, on September 25, 300 cc of chocolate-colored, thick, viscid pus mixed with gas

⁶¹ Ueber Gasphlegmonen, p 15, Hamburg and Leipzig, 1893 62 Bull et mem Soc med d hop de Paris, 1900, 3 S, XVII, p 216

were aspirated, and 8 days later an incision, from which 200 cc. of reddish pus escaped, was made, after which the abscess slowly healed. Aerobic cultures were negative, in anaerobic cultures Bacillus aerogenes capsulatus (Veillon and Zuber's Bacillus perfringens) was obtained in pure culture. From the foul odor of the pus and gas, which is said to have been distinctly that of sulphuretted hydrogen, it is probable that, at least at some stage of the process, other microorganisms were associated with the gas-bacillus, which survived for nearly a month in the abscess.

The same authors report a second case of gaseous abscess, which in this instance followed the injection of artificial serum into the abdominal walls of a child with grave typhoid fever. The abscess, which was opened by thermo-cautery, contained yellowish, viscid, inodorous pus. Three aerobic organisms, of which Staphylococcus aureus predominated, were found associated with Bacillus aerogenes capsulatus.

Soupault and Guillemot describe a third case of a young man, to wears old in whom a generoous phlegmon with extensive

19 years old, in whom a gangrenous phlegmon with extensive sloughing followed an injury of the left leg received in playing foot-ball. After the critical condition seemed to have passed, foot-ball. After the critical condition seemed to have passed, an emphysematous subcutaneous swelling appeared in the opposite, healthy leg near the inside of the knee. A hypodermic injection of salt solution had been made in the external part of the right thigh, but the authors do not consider that this had anything to do with the gaseous swelling, as the latter was too remote from the site of injection. They, therefore, attribute the gaseous phlegmon to transportation of bacilli by the circulation from the opposite extremity. Bacillus aerogenes capsulatus was found in pure culture. Recovery was uninterrupted. Soupault and Guillemot emphasize the benign course of the affection in their three cases, as well as in other instances of gaseous abscess following hypodermic injections which they cite from published records. Conditions favoring the occurrence of such abscesses after these injections are the irritating quality of the fluids injected (ether, tincture of musk, camphor, acid solutions of morphine, concentrated saline solutions, etc.) and lowered general resistance of the patient produced by typhoid fever,

tuberculosis, cancer, cholera, haemorrhages, and other grave diseases. When death occurs, they think that it is usually attributable to the primary disease, not to the infection with the gas-bacillus

I have included in my statistics of emphysematous gangrene 5 cases of gaseous phlegmon following hypodermic injections, 3 of these (Carroll 2, Dobbin 1) being of normal salt solution in puerperal women, and 2 (E Fraenkel) being respectively of oil of camphor followed at once by ether in a patient after extirpation of a pyloric cancer, and of a solution in water of sulphuric acid and muriate of morphia in cholera. That the most unirritating of solutions may be followed by gaseous phlegmon is demonstrated by the three cases in which physiological salt solution was injected. Of these latter two died, and one recovered after incision of the phlegmon. Both of Fraenkel's cases terminated fatally

Including Soupault and Guillemot's 3 instances of gaseous abscess we have altogether 8 cases of gaseous abscess or phlegmon following hypodermic injections of various substances, and caused by Bacillus aerogenes capsulatus, usually in association with other bacteria

(p 197) Brieger and Ehrlich's⁶³ two observations of fatal gaseous phlegmon following the hypodermic injection of tincture of musk in typhoid fever are usually cited as the first instances of authenticated malignant edema in man, but it cannot be said that the bacillus concerned was proven beyond doubt to be that of malignant edema, and with our present knowledge of the etiology of this class of affections it is permissible to question the accuracy of the identification of the bacillus in these two cases, notwithstanding the high authority of the observers. In the case of gaseous abscess following the intramuscular injection of ether reported by Bucquet,⁶⁴ and in the two similar cases reported by Lauteret,⁶⁵ all three ending in recovery, no bacteriological examination was made

⁶³ Berliner klin Woch , 1882, XIX, p 661

⁶⁴ These, Paris, 1883

⁶⁵ These, Paris, 1898

It is evident from the foregoing cases that Bacillus aerogenes capsulatus, in combination usually with pyogenic bacteria, is the chief, if not sole, cause of the gaseous abscesses or emphysematous gangrene which occasionally follow hypodermic injections. Although in none of the cases reported has this bacillus been looked for in the fluids injected, the presumption is that it was present either in them or in the syringe, although there is a possibility of the introduction of this organism from the skin of the patients, and even of its conveyance by the circulation from the intestine to the site of tissues damaged by the injection of irritating substances

I shall refer subsequently to the occurrence of the gas-bacillus in abscesses without gas and to other manifestations of its pyogenic capacity.

UTERINE INFECTIONS

Knowledge of Bacillus aerogenes capsulatus is of not less interest and importance to the obstetrician than to the surgeon. Infection of the puerperal uterus by this microorganism leads to a variety of morbid conditions, some comparatively mild, others of the utmost gravity.

The wide distribution of the bas-bacillus in the intestinal canal and the outer world renders as explicable the occasional presence of this bacillus in the female genital tract as that of the colon bacillus in the same situation. Lindenthal⁶⁶ found the gas-bacillus in the vagina without the presence of gas or other pathogenic effects twice out of six puerperal cases examined. According to the observations of others, Lindenthal's experience would seem to be exceptional. As with so many other pathogenic bacteria the mere presence of the organism upon exposed surfaces does not necessarily signify infection.

I shall consider the uterine infections by the gas-bacillus under the headings of emphysema of the fetus, puerperal endometritis, physometra, emphysema of the uterine wall, and puerperal gassepsis, although these conditions may be associated with each other. Emphysema of the Fetus.—The occurrence of emphysema in the dead fetus in utero has been known for centuries,⁶⁷ but it was not until 1897, when Dobbin published his paper on "Puerperal Sepsis due to Infection with the Bacillus aerogenes capsulatus"⁶⁸ that the cause of this condition was determined to be invasion by Bacillus aerogenes capsulatus. In this case gas and the gas-bacillus were both recognized during the life of the patient in the fetus, the placenta and the cavity of the uterus, and after death there was general gas-formation throughout the body.

Dr. Dobbin has kindly given me the notes of a second, unpublished case observed by him. He was called to see a woman in difficult labor, upon whom repeated attempts at delivery of a dead fetus had been made. Upon examination he recognized crepitation of the caput succedaneum while the fetus was still in utero. Upon delivery the fetus was emphysematous with foamy organs The gas bacillus was found in pure culture in the fetus and mixed with other bacteria in the amniotic fluid. No gas was recognized in the uterus after delivery. The patient made a good recovery without evidence of sepsis

Menge and Kronig⁶⁹ have observed three instances of fetal infection by the gas-bacillus and have brought strong evidence that usually the invasion is through the mouth of the fetus, the bacilli being taken into the lungs or stomach by inspiring or swallowing amniotic fluid. In their cases the bacilli were not found in the part of the umbilical cord attached to the placenta, but in Dobbin's first case this as well as the placenta itself was infected with the gas-bacillus. The amniotic fluid within the intact membranes, as is well known, is usually sterile, and only exceptionally becomes infected before rupture of the membranes, so that the infection of the fetus from this source is generally after this rupture. As shown by Menge and Kronig, all grades of invasion of the fetus by the gas-bacillus occur, so that there

er It is usually stated that this condition was known to Celsus, but he does not expressly mention the presence of gas, although this is to be inferred. In the chapter on extraction of the dead fetus, he says "Solet etiam evinire, ut is infans humore distendatur, exque eo profluat foedi odoris sanies" Milligan's "Celsus," p. 394, Edinburg, 1831

⁶⁸ Bulletin of the Johns Hopkins Hospital, 1897, VII, p 24

⁶⁰ Bakteriologie des weibl Genitalkanales, Teil II, p 167, Leipzig, 1897

may be only a small amount of gas, and this limited to the lungs or the alimentary canal or both. The medico-legal importance of not mistaking for air this gas in the fetal lungs produced by gasbacilli should be emphasized.

As is well known, fetal emphysema is usually unattended with danger to the mother. In two of the five cases due to Bacillus aerogenes capsulatus in my list the puerperium was even without rise of temperature, in two there was mild fever, but in Dobbin's first case there was rapidly fatal gas-sepsis.

Puerperal Endometritis - Under the heading "gas-sepsis" will be considered cases of acute uterine infection with the (p. 198) gas-bacillus followed by invasion of the blood and organs by this Here it may be mentioned that Bacillus aerogenes capsulatus may be present in the uterus, usually in association with other bacteria, in both mild and severe cases of puerperal endometritis without the recognition of gas in the fetus, or the uterine cavity, or wall. An example of such a case is an unpublished one in the service of Dr J Whitridge Williams, of which the notes have been furnished me by Dr Dobbin A woman with rhachitic pelvis, upon whom delivery by forceps had been attempted before admission to the Johns Hopkins Hospital, was there delivered by craniotomy There was no gas in the fetus Forty-eight hours later Bacillus aerogenes capsulatus, together with streptococci, was found in the uterine lochia detected The patient developed fever, but recovered

In two cases, one reported by Dobbin⁷⁰ and the other by Blumer,⁷¹ the gas-bacillus, although not identified with absolute certainty, was probably present in the puerperal uterus in association with the typhoid bacillus

Physometra —Distension of the uterine cavity with gas (physometra or tympany of the uterus) was present in Dobbin's first case, already cited, and is often associated with emphysema of the dead fetus, but may occur without the latter and even in the non-

⁷⁰ Am Journ Obstetrics, 1898, XXXVIII, p 185

⁷¹ Ibid, 1899, XXXIX, p 42

pregnant uterus This curious condition was formerly ascribed to entrance of air or to ordinary putrefaction, 72 but it is now known to be the result of the activity of gas-producing bacilli

Since the observations of Lindenthal, 72 reported in 1898, it cannot be doubted that Bacillus aerogenes capsulatus is the chief cause of physometra. He found this bacillus in five cases during life and reproduced the condition experimentally in guinea-pigs. He is justly skeptical of the correctness of the previous reports of Beghard 14 concerning the agency of the colon bacillus in generating gas within the uterus. We know from Theobald Smith's investigations that the colon bacillus can produce gas only from carbohydrates, whereas it is the most distinctive biological attribute of our gas-bacillus that it can produce gas from proteids. Until it has been shown that the amniotic fluid and uterine contents may under any conditions contain enough carbohydrate to explain the development of gas by the colon bacillus there is every reason to question the claims for this bacillus as a cause of tympany of the uterus 15

My list of cases contains to instances of physometra in which Bacillus aerogenes capsulatus was demonstrated. Although as some of our cases show, this condition may be associated with invasion of the bacilli into the wall of the uterus and by acute gas-sepsis, these occurrences are exceptional and the prognosis is in general a favorable one. Most of the cases furnish a good illustration of the resistance of living human tissues to the action of the gas-bacillus. Doubtless in these cases the bacilli grow simply in the amniotic fluid after rupture of the membranes, and in the dead fetus, these offering no vital resistance, whereas we must suppose that the intact uterine wall offers ordinarily an effective resistance to the invasion and multiplication of the gas-bacillus. That occasionally the bacilli may find other dead

⁷² The older hypotheses and records on physometra and emphysema of the fetus are fully presented by Staude, Zeitschr f Geb u Gynak, 1878, III, p 191

⁷³ Monatsschr f Geb u Gynak, 1898, VII, p 269

⁷⁴ Zeitschr f Geb u Gynak, 1893, XXVI, p 480, and 1897, XXXVII, p 132

⁷⁶ Halban (Monatsschr f Geb u Gynak, 1900, XI, p 102) states that he has found lactose once in the amniotic fluid of a normal puerpera Further studies of this subject are needed

material in the uterus, as in sloughing myomata and cancers, is evident from the histories of some cases of physometra

Emphysema of the Uterine Wall.—Far graver in significance is septic emphysema of the uterine wall, of which Halban has recently reported an interesting case due to Bacillus aerogenes capsulatus. Graham, Steward and Baldwin and P. Ernst were the first to demonstrate this bacillus in this condition, their papers, to which reference has already been made, appearing simultaneously in August, 1893. Eleven instances of emphysema of the wall of the uterus, all puerperal, have been reported, of which 5 were recognized during life. In all but Halban's case there was also physometra, and this would seem to be a necessary accompaniment unless the cervical canal is open so as to permit the escape of the gas from the uterine cavity. All of the cases were fatal, and in most gas was found at autopsy in the blood and internal organs.

Subperitoneal emphysema is a condition which has been observed after rupture of the uterus, Dischler77 having collected reports of 14 cases In most instances this has been attributed to entrance of air, but I think that it is safe to predict that the gas-bacillus will be found in similar cases in the future, if proper methods for its detection are employed I know, however, of no instance of this condition in which it has been looked for.

Puerperal Gas-Sepsis -I have adopted from Halban the term "gas-sepsis" as a convenient one-although, perhaps, open to criticism—to designate the important group of fatal puerperal cases in which gas-bubbles are found at early autopsies in the heart and vessels and often also in the organs and tissues under conditions where we must suppose that gas-bacilli and possibly gas have passed from the uterus into the circulation during life 78 Here in my opinion belong most of the cases which have been reported as deaths due to the entrance of air into the uterine veins.

⁷⁶ Monatsschr f Geb u Gynak, 1900, XI, p 88

⁷⁷ Arch f Gynak, 1898, LVI, p 199

⁷⁸ Gas-sepsis in this sense occurs also in other than uterine infections with the gasbacıllus.

This opinion which I expressed in my first communications on the gas-bacillus in 1891 and 1892, received prompt confirmation in the papers (p 199) of Graham, Steward and Baldwin and of P. Ernst in August, 1893, and has since been strengthened by other similar observations. Cases described by Wendeler as sepsis acutissima belong also in the same category

My list includes 13 puerperal cases in which gas-bubbles and the gas-bacillus were found at autopsy in the blood or organs, but in only 7 of these does it seem to me conclusive or extremely probable that the infection occurred during life 80

The most remarkable of these cases is that reported by Graham, Steward and Baldwin of a woman, upon whom abortion had been recently produced, who during the four hours immediately preceding death became emphysematous over nearly the whole body. At the autopsy gas and gas-bacilli were found everywhere throughout the body. In Dalton and Bremer's⁸¹ case, also one of criminal abortion, an emphysematous swelling of the arm and pectoral region was likewise recognized during life. These cases are of importance as demonstrating the invasion of the body by the gas-bacillus from the uterus while the blood is still circulating In Halban's and Dobbin's cases gas was also recognized during life within the wall or cavity of the uterus

In the majority of cases of puerperal gas-sepsis there has been some operative interference preceding infection, such as criminal abortion, forced delivery for placenta praevia or other causes, or the manipulations of an unskilled midwife. The fulminating character of the infection, death being sometimes very sudden, is a notable feature of many of the cases

In a case of attempted criminal abortion reported by Perkins,⁸² the patient, according to the statement of the practitioner in whose office death occurred, died suddenly, and at the autopsy

⁷⁹ Monatsschr f Geb u Gynak, 1896, IV, p 581

⁸⁰ These are the cases reported by Graham, Steward and Baldwin, P Ernst, Menge and Kronig, Dobbin, F C Wood (Med Record, Apr 15, 1899), Cesaris-Demel, and Halban, to whose papers references have already been given

⁸¹ Am Journ Med Sc, 1888, XCV, p 594 This infection, although attributed to the bacillus of malignant edema, was probably due to the gas-bacillus

²² Boston Med and Surg Journ, 1897, CXXXVI, p 154.

twelve hours later in cold weather, gas was found in the vena cava, heart, and other vessels, with evidences of injury to the pregnant uterus. The case was reported by Perkins as one of death from air-embolism, and certainly with as much and even more plausibility than most cases thus reported. After the publication, Dr. Perkins, upon the request of Dr. Dobbin, was so good as to send the uterus, well preserved in alcohol, to my laboratory where Dr. Dobbin demonstrated in the uterine vessels and tissue bacillis morphologically and in staining reaction identical with Bacillus aerogenes capsulatus. 83

I would not be understood to deny the possibility of the occurrence of fatal air-embolism from the uterus. A very few of the reported cases are difficult to interpret upon any other supposition, but I do claim that the foundations of this doctrine have been seriously shaken by our discovery and investigations of the gasbacillus, and that no case, however plausible, can be considered as positively proven without a satisfactory bacteriological exam-The limitation of gas to the right heart and adjacent vessels may occur from invasion by the gas-bacillus, and is not, as often represented, peculiar to air-embolism. Did we not know how long it takes new knowledge, especially that originating in this country, to penetrate throughout the medical world, it would be amazing that cases should still continue to be reported, as they are,84 of deaths ascribed to air-embolism without any bacteriological examination or even any reference to the possibility of any other explanation I am not aware that in any instance of alleged air-embolism, a bacteriological examination has been made, which would exclude the presence of gas-forming bacteria.

Whether, as suggested by Staude, in any of the cases with gas within the uterine cavity, death is attributable to gaseous em-

⁸³ Dobbin has reported the results of his examination with further notes of this case in the Monatsschr f Geb u Gynak 1897, VI, p 375

⁸⁴ Zorn (Munch med Woch, 1898, p 567) may be cited as an example Hubl (Wiener klin Woch, 1900, XII, p 111) has also recently reported two instances of alleged air-embolism—placenta praevia—without any bacteriological examination. He assumes incorrectly that the distribution of the gas at autopsy is a decisive point as between air-embolism and gas-sepsis.

bolism, is, I think, an open question. It is possible, although I know of no proof of it, that in some of the cases of sudden death during or immediately after some manipulation or operation on the pregnant uterus and attributed to air-embolism, gas, generated by bacteria, may have existed under pressure within the uterine cavity and have entered wounded veins in sufficient amount and so suddenly as to have caused death

To what extent the free gas found in the blood-vessels, heart and internal organs, even very soon after death from what has been described as puerperal gas-sepsis, is there during life, is a question difficult to answer. I have already considered this subject, and in this connection shall again emphasize the importance of caution in interpreting the presence of gas in these situations as a vital phenomenon, although there is evidence that it may be such

INFECTIONS OF THE URINARY TRACT

There is evidence that the urinary tract may not only be a portal of entrance for the gas-bacillus into the circulation or adjacent tissues but also be itself the seat of infection by this organism. Unfortunately for the decisive interpretation of many of these cases, Bacillus aerogenes capsulatus has, so far as I am aware, hitherto been found in the urinary tract only after death, although in some instances so soon thereafter and under such conditions that its presence during life cannot be doubted.

I have already called attention to instances of emphysematous gangrene following external urethrotomy and other operations on the urinary passages

(p 200) Among the cases of general invasion of the blood and organs (foamy organs) by the gas-bacillus observed by myself and others are several in which the portal of entry was the urethra, bladder or other part of the urinary tract ⁸⁵ In a case of urethral stricture with cystitis, for which perineal section had been done, reported by Welch and Flexner, gas-bacilli were found the equarters of an hour after death in large numbers in the bladder,

⁸⁵ Such cases are reported by Welch and Flexner, Goebel, Dunham and Howard in papers already cited

ureters and renal pelvis, and a few gas-bubbles and gas-bacilli were already present in the blood of the right ventricle. In Howard's case of meningitis caused by the gas-bacillus, to be cited subsequently, he considers that the portal of entry was the urinary tract.

Gas, generated by Bacillus aerogenes capsulatus, has been found in the urinary passages in 6 cases which have come to my notice. The gas may be either free in the cavity of the bladder, ureters or renal pelvis, or contained within submucous blebs, or in both situations.

Welch and Flexner⁸⁷ have reported an instance of pneumaturia in a diabetic man in whom, six hours after death, without trace of cadaveric decomposition, the urinary bladder was found filled with frothy urine containing Bacillus aerogenes capsulatus in pure culture. This case indicates that the colon bacillus and Bacillus lactis aerogenes are not the sole causes of pneumaturia in diabetics. Dr. Flexner has given me the notes of a second case of pneumaturia upon which he made the autopsy at the University Hospital, Philadelphia This was of a patient with chronic cardiac disease who had been catheterized twenty-eight hours before admission and who died thirty hours after admission the autopsy, made one hour and a half after death, about 60 cc. of frothy urine were found in the bladder from which Bacillus aerogenes capsulatus, together with Staphylococcus aureus and Streptococcus pyogenes (no colon bacilli), was cultivated. Neither gas nor gas-bacilli were found elsewhere in the body. The mucous membrane of the bladder was edematous. can be little doubt that in this case the gas-bacillus was introduced by the catheter into the bladder.

In one of Welch and Flexner's cases (Case XVIII) of hypertrophied prostate with pyoureter and pyonephrosis, the renal pelves and ureters were found at autopsy distended with gas and containing pus mixed with bubbles of gas Small gas-cysts were present in the mucous membrane of the renal pelves Neither

⁸⁶ These do not include some instances of very extensive post-mortem emphysema of the organs with gas everywhere throughout the body

⁸⁷ Case XIII of our list in Journal of Experimental Medicine, 1896

gas nor gas-bacilli were present outside of the urinary organs. In this case cocci and colon bacilli were associated with the gas-bacillus

In the case of Dr Kelly's, of which the full records have been given me by Dr. Miller,88 there was pneumaturia demonstrated by cystoscopic examination and ureteral catheterization to come exclusively from the inflamed left renal pelvis and ureter. Among cocci and other bacteria were found on coverslips bacilli morphologically resembling Bacillus aerogenes capsulatus, but unfortunately no anaerobic cultures were made. None of the bacteria which grew aerobically produced gas in lactose-agar. This case is interesting as demonstrating that the gas may come exclusively from one renal pelvis and ureter, but the microorganism producing the gas was not satisfactorily demonstrated. It seems certain that it was an anaerobic organism, and from the microscopical appearances may have been the gas-bacillus

The subject of submucous gas-cysts will be considered subsequently, but here it may be mentioned that besides the gas-cysts in the renal pelves noted by Welch and Flexner in the case already cited, Goebel found gas-blebs, containing in pure culture Bacillus aerogenes capsulatus, beneath the mucous membrane of the urinary bladder, without gas elsewhere in the body, and Dunham has reported a like condition of the bladder in a case of emphysematous gangrene with general invasion of the blood and organs by the gas-bacillus

Bacteria have been found in emphysema of the bladder (cystitis emphysematosa) also by Eisenlohr, 89 Camargo, 90 and Kedrowsky, 91 but it is impossible from the authors' descriptions to identify their bacteria. Kedrowsky considers that the bacillus isolated by him is allied to Bacillus aerogenes capsulatus, but less sensitive to oxygen. Perhaps it was Sanfelice's Bacillus pseudoedematis maligni, to which I have already referred, but Kedrow-

⁸⁸ This case is briefly reported by Kelly and MacCallum, Journ Amer Med Assoc, 1898, XXXI, p 376, whose paper may be consulted for the full literature of pneumaturia

⁸⁹ Ziegler's Beitr, 1888, III, p 101

⁹⁰ These de Geneve, 1891

⁹¹ Centralbl f allg Path u path Anat, 1898, IX, p 817

sky's description of his cultures hardly inspires confidence in their purity.

Welch and Flexner and Howard have reported finding the gas-bacillus, in association with other bacteria, in inflammatory lesions of the bladder, renal pelvis and kidneys, without the detection of gas. Howard considers that in one of his cases the bacillus was concerned in the etiology of suppurative lesions of the kidneys but in this case the colon bacillus and Streptococcus pyogenes were also present.

INFECTIONS DERIVED FROM THE GASTRO-INTESTINAL CANAL

Mention has already been made of the frequent, if not constant, presence of Bacillus aerogenes capsulatus in the intestinal canal, of gaseous phlegmons originating from this source, and of the readiness with which intestinal bacteria may gain access to the genito-urinary tract.

The intestine is by far the commonest source of the gas-bacilli found together with gas-bubbles in the blood and organs at autopsies This invasion may occur either with or without definite intestinal lesions, and is probably in the majority of cases an agonal or post-mortem event. The mode of distribution and spread of the bacilli in these cases has (p. 201) been well described by Howard,92 whose experience has been exceptionally large with Especially demonstrative of invasion this class of affections of gas-bacilli from the intestine, usually post mortem, is the occurrence of gas-bubbles limited to the neighborhood of the intestine, as in the intestinal wall, within the portal or mesenteric veins, or lymphatis, in the subperitoneal tissues, mesentery and omenta, around the pancreas, in the mesenteric gland, and especially in the loose tissue near the gall-bladder and in the porta of the liver, without gas in more remote situations I have seen examples of each of these occurrences in very early autopsies without ordinary cadaveric decomposition

Local Gastro-intestinal Lesions —Interstitial emphysema of the gastro-intestinal wall will be considered subsequently.

⁹² Op cit, p 49¹

Howard has described several cases with larger or smaller areas of superficial necrosis of the mucous membrane of the stomach and intestine, in which gas-bacilli were present in large numbers. These areas, which may occur either with or without gas-cysts, are found most frequently beneath the folds of the valvulae conniventes and are characterized by absence of nuclear staining and disintegration of the cells and tissue, usually without marked inflammatory reaction.

Bacillus aerogenes capsulatus may undoubtedly be a cause of meteorism. Instances of this are reported by Welch and Flexner and by Howard.

Pneumo-peritonitis with and without Perforation.—My records include 13 cases of diffuse peritonitis in the exudate of which Bacillus aerogenes capsulatus was found Eleven of these were in autopsies made either by Dr. Flexner or myself, 7 having already been published by us in 1896. The remaining 2 cases (both being perforations of gastric ulcers) have been reported by Page, 33 and by Pratt and Fulton 34 It was the observation of these cases which first called my attention to the frequent presence of the gas-bacillus in the intestine

Ten of the cases were perforative and 3 were non-perforative. Of the former 4 were the result of perforation of typhoid ulcers, 4 of gastric ulcers, 95 one of strangulated, gangrenous intestine and one of a cancerous ulcer of the duodenum. In the last case (autopsy fourteen hours after death) the exudate was sero-fibrinous and the gas-bacillus was found in pure culture 96 and abundantly in the peritoneal cavity and was absent from other organs and the blood. In the other perforative cases the gas-bacillus was mixed with other bacteria, although in some in-

⁹³ Canada Lancet, May, 1900

⁹⁴ Boston Med and Surg Journ, June 7, 1900, p 599

⁹⁵ Welch and Flexner have reported an instance of peritonitis from perforated gastric ulcer in a rabbit, in which the gas bacillus was found

The purity of the culture in this case is explicable by the results of Cushing and Livingood's interesting bacteriological and experimental studies of the duodenal flora published in Contributions to the Science of Medicine, Dedicated by his pupils to William

Henry Welch on the 25th Anniversary of his Doctorate, p 543, Baltimore, 1900

stances it predominated In all of the cases the abdomen was greatly distended with gas and usually there was great tympanites.

I attach especial importance to the case fully reported by Welch and Flexner, 97 in which we brought conclusive evidence of the occurrence of pneumoperitonitis without perforation, the first of the kind on record in which similar proof was obtained The presence of gas in the peritoneal cavity was recognized during life. Since our publication a similar case has been observed by Dr. Flexner in Manila, who has kindly furnished me the notes At the autopsy, twelve hours after death, there was found haemorrhagic infarction of the lower part of the ileum and adjacent part of the large intestine, caused by the passage of this part of the intestine through a hole in the mesentery. The peritoneal cavity was greatly distended with gas which burnt with a pale, blue flame There was a large amount of frothy, bloody serum in the peritoneal cavity together with a fibrinous exudate. The most careful examination showed no perforation. Bacillus aerogenes capsulatus was obtained in pure culture and abundantly from the peritoneal fluid. Gas was absent from the blood and other organs.

We have found the gas-bacillus, mixed with other bacteria, twice in circumscribed, gas-containing, intraperitoneal abscesses resulting from perforation of the appendix vermiformis.

Hepatic and Biliary Infections—The development of gas in the liver is so striking a phenomenon in most autopsies where the gas-bacillus and free gas are found in the blood and organs that P. Ernst used the term "Schaumeleber" for the title of his article on the gas-bacillus, published a year after the paper by Welch and Nuttall, in which we first directed attention to the subject of foamy organs and the gas-bacillus 98 I have already considered the general subject of gas-bubbles in the blood and organs,

⁹⁷ Op cit, p 35
98 Heydenreich's paper on "Emphysem der Leber" (Centralbl f Bakter, 1897, XXI, p 305) may be mentioned as a curiosity He had never heard of the gas-bacillus or of any other investigation of the subject later than 1872 In contrast to this is the interesting article of P Bernhardt on pneumathaemia and foamy organs with full consideration of the recent literature Deutsche med Woch, 1900, p 83

and wish here to call attention especially to infections of the gall-bladder and biliary passages by Bacillus aerogenes capsulatus

In cases of foamy liver gas may be found in the bile-ducts and gall-bladder, but my experience is that, when the gas-bacilli reach the liver through the blood-vessels, the appearance of gas in these situations is a rather late occurrence and met chiefly in advanced cases. In contrast to these cases are the observations of gas in the biliary passages, associated sometimes with definite lesions of the bile-ducts and liver, where the evidence is that the gas-bacilli entered from the (p 202) intestine directly into these passages. Two such cases have been reported by Howard, 90 and I have observed two cases.

Pratt and Fulton¹⁰⁰ report a remarkable case of cancer of the common bile-duct and pancreas in which cholecystotomy was performed, the edges of opening in the gall-bladder being stitched to the abdominal walls. At the autopsy the liver was found studded with minute abscesses with greenish translucent walls. In coverslips, sections and cultures Bacillus aerogenes capsulatus was found in pure culture in these small biliary abscesses, but there was no gas in the abscesses, the liver, blood, or other organs. A somewhat similar case, in which cholecystenterostomy for gall-stones had been performed, was previously reported by Nichols101 from Adami's laboratory. Here also multiple miliary abscesses containing the gas-bacillus were found in the liver, but in this case gas was present in the liver, as well as in the blood and other organs, the autopsy being six hours after death Larkin102 has likewise reported a case of haemorrhagic pancreatitis with fat necroses and small, multiple hepatic abscesses with gas-holes in the liver, from which Bacillus aerogenes capsulatus was isolated. The autopsy was eight hours after death

Hintze¹⁰³ has recorded a post-mortem observation of gas in the inflamed bile-ducts with cholelithiasis He cultivated only the

⁹⁹ Contributions to the Science of Medicine, Dedicated by his pupils to William Henry Welch on the 25th Anniversary of his Doctorate, pp 475 and 476, Baltimore, 1900

¹⁰⁰ Boston Med and Surg Journ, June 7, 1900, p 599

¹⁰¹ Brit Med Journ, 1897, II, p 1844

¹⁰² Med Record, 1898, LIII, p 354

¹⁰³ Munch med Woch, 1895, XLIII, p 209

colon bacillus, but it does not appear that he made anaerobic cultures

From the foregoing cases it is to be inferred that the gas-bacillus may invade the bile-ducts and gall-bladder from the intestine, and sometimes during life, and that it may not only produce gas but also necroses and purulent inflammation. The presence of gall-stones, cancer of the bile-ducts and operations on the gall-bladder favor this mode of infection.

Rist¹⁰⁴ found the gas-bacillus (Bacillus perfringens), without gas or other lesion attributed to it, in an extirpated gall-bladder containing a calculus and clear viscid fluid.

INTERSTITIAL EMPHYSEMA OF THE GASTRO-INTESTINAL, GENITO-URINARY AND BILIARY TRACTS

One of the most interesting lesions produced by Bacillus aerogenes capsulatus is the formation of submucous or subserous gas-cysts or blebs, of which the earliest examples attributed to this organism were reported by P. Ernst, Goebel, and Welch and Flexner They are sufficiently common to have been observed by nearly all investigators who have had much experience with the gas-bacillus in human beings My list of cases includes 25 instances of this condition, of which 5 were of the stomach, 11 of the intestine (far oftener of the small than the large intestine), 5 of the gall-bladder and bile-ducts, 3 of the urinary bladder, 1 of the renal pelvis, and 1 of the vagina The majority of the cases were observed by Flexner, Howard, and myself, and in all the gas-bacillus was demonstrated. The case of emphysema of the vagina was reported by Lindenthal. 105

These gas-cysts vary in size from microscopic dimensions to large blebs. They are most common in the submucous coat, but may be present in the mucous membrane, the muscular coat or beneath the serous covering, in fact, in any part of the membranous wall. They may be few or in enormous numbers, in groups or scattered. In one of our cases the whole small intestine from the duodenum to the ileocoecal valve was studded with small

¹⁰⁴ These, Paris, 1898

¹⁰⁵ Wiener klin Woch, 1897, pp 3 and 35

gas-cysts Gas-cysts of the same general character may be found in the mesentery and omenta.

These gas-cysts are in their inception simply such gas-holes as we are already familiar with in the liver and other organs in cases of local or general invasion with the gas-bacillus. They indicate a foamy or emphysematous condition of the walls of the stomach, intestine, gall-bladder, bile-ducts, urinary bladder and vagina, due to the invasion into these parts of the gas-bacillus

The condition of the walls of the blebs and of the surrounding tissues varies. Some of the cavities are round and their walls smooth, others are irregular in shape and have ragged walls. They may correspond to dilated lymphatics, but more frequently they do not represent dilatation of any performed channels. There may be communication between adjacent cavities, but oftener the cysts are distinct from each other. The tissue in the immediate neighborhood of the cavities may present no alteration not explicable by the mechanical pressure of the gas, or it may show necrosis in varying degree and extent. Inflammatory changes or cellular reaction which could be reasonably referred to the presence of the cysts or of the gas-bacilli causing them were not noted. Sometimes a little coagulated, homogeneous or granular material is present in sections of the cysts in hardened tissues, as indeed may often be found in gas-holes in the organs.

In sections stained by Gram there is usually no difficulty in demonstrating the relation of the gas-bacilli to the cysts. The bacilli may be in masses in the walls of the cysts, but sometimes they are not more numerous there than in the tissue at a distance from the gas-blebs, and occasionally it requires some searching to find them. By anaerobic methods the gas-bacillus can be cultivated from the cysts or the adjacent tissue.

All of the instances of submucous and subserous gas-cysts in my list were observed post mortem. In the larger number of cases gas-bacilli and gas-bubbles were more or less widely distributed in the blood and organs, but without evidences of ordinary post-mortem decomposition. There are, however, several cases in which these gas-cysts in various situations were the sole

manifestation of the presence of the gas-bacillus in the body. Howard has shown that if careful, systematic (p 203) search is made for areas of necrosis and minute gas-cysts due to Bacillus aerogenes capsulatus in the stomach and intestine, these lesions can be found much more frequently than has been supposed.

It is, with our present information, a difficult matter to say in how many of these cases the emphysematous state existed before death. It is certain that, at least in the great majority of cases in my list, the emphysema was not the result of ordinary post-mortem decomposition. In a large number of the cases the autopsy was made within a few hours after death. Howard, in one of his cases of gas-cysts, limited to the intestine, made the autopsy one hour after death. I have already emphasized the importance of great caution in interpreting as vital processes the various gaseous conditions of parts and organs not open to inspection during life, even when autopsies are made soon after death and there is entire absence of putrefaction, and I can only repeat this caution here. Mere absence of nuclear staining around gas-holes I do not regard as proof of their origin during life.

It would lead altogether too far to enter here into a discussion of the general subject of submucous gas-cysts concerning which there is a large literature, the principal refenerces to which will be found in the articles of Eisenlohr, 105 Camargo, 107 Winands, 108 Orlandi, 108a Duprazios and Lindenthal. 110 It would appear from a study of the records of the subject that anatomically different conditions have been described under the designation "gas-cysts" (cystides aeriferae). Some have been apparently of long standing and show chronic inflammatory changes in the walls of the cysts and the surrounding tissues. The most voluminous records relate to the gas-cysts of the vagina (kolpohyperplasia cystica of Winckel, emphysema vaginae of Eppinger).

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105 Ziegler's Beitrage, 1888, III, p 101.
107 These de Geneve, 1891
108 Ziegler's Beitrage, 1895, XVII, p 38
108a Gazz med di Torino, 1896, XLVII, p 781
109 Arch de med exper, 1897, IX, p 282
110 Wiener klin Wochenschr, 1897, pp 3 and 35
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At present we have no warrant to identify the more chronic gas-cysts with thickened walls with the more acute emphysematous condition which I have described as referable to Bacillus aerogenes capsulatus Nevertheless the former are probably of bacterial origin also, although I am unable to accept the bacteriological findings of Eisenlohr, Camargo, Orlandi and Dupraz as at all convincing, for they made no use of anaerobic methods of cultivation. It is quite possible that Bacillus aerogenes capsulatus is concerned also in the etiology of the gas-cysts of long standing, certainly it is important to apply hereafter anaerobic cultural methods to their study Lindenthal has no hesitation in identifying the emphysema of the vagina observed by him post mortem and from which in a single case he cultivated what he chooses to call Bacillus emphysematis vaginae (in reality our Bacillus aerogenes capsulatus) with Winckel's kolpohyperplasia cystica, but, while he may be correct, further observations are needed before their anatomical and etiological identification can be accepted.

The only instance in which gas-cysts of the human intestine have been recognized during the life of the patient is reported by Hahn, who found them in large number upon opening the abdomen. It is to be regretted that no thorough bacteriological examination of this case was made.

In my original communication on the gas-bacillus I ventured the surmise that the bacillus found by E. Fraenkel¹¹² in hardened sections from a case of gastritis emphysematosa might be identical with Bacillus aerogenes capsulatus, and this suspicion has gained in probability by Goebel's statements based upon a re-examination of the sections, his work having been done under Fraenkel's supervision

Notwithstanding an effort at compression, so much space has been occupied in the presentation of the foregoing subdivisions of our subject, which in less than a decade has grown to consid-

¹¹¹ Deutsche med Woch , 1899, p 657

¹¹² Virchow's Archiv, 1889, CXVIII, p. 526

erable magnitude, that I shall only summarize very briefly a few remaining topics, although all deserve fuller treatment

Pulmonary and Pleural Infections.—To the two instances of invasion of the lungs by the gas-bacillus reported by Welch and Flexner, I can add the cultivation of this organism from a gangrenous lung by Dr. Flexner in my laboratory. It has been found also by Guillemot¹¹³ and Rist¹¹⁴ in pulmonary gangrene.

Of much importance is Levy's¹¹⁶ demonstration of Bacillus aerogenes capsulatus as a cause of pneumothorax without perforation. This case and those of pneumoperitoritis without perforation to which I have already referred have settled affirmatively the long standing controversy concerning the possibility of the generation of gas within closed serous sacs during life. Nichols¹¹⁶ has reported an instance of pneumothorax and pneumopericardium without perforation in which the gas-bacillus was probably present. Rendu and Rist¹¹⁷ also isolated the gas-bacillus (Bacillus perfringens) in a case of putrid pleurisy with gas. May and Gebhart¹¹⁸ and Finley¹¹⁹ attribute their two cases of pneumothorax without perforation to the colon bacillus, but in neither were anaerobic cultures made. It is important that in all gaseous affections anaerobes should be searched for.

Bacillus Aerogenes Capsulatus in the Blood during Life—(p 204) Extremely interesting is the demonstration by Gwyn,¹²⁰ both by coverslip specimens and by cultures, on repeated examinations, of Bacillus aerogenes capsulatus during life in the blood of a patient, in the Johns Hopkins Hospital, with chorea insaniens and acute endocarditis. I had the opportunity of examining his

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118 These, Paris, 1898
114 These, Paris, 1898
115 Arch f exp. Path. u Pharm, 1895, XXXV, p 335
116 Loc cit
117 Bull et mem Soc med d hop de Paris, 1899, 3 S, XVI, p 133
118 Deutsches Arch f klin Med, 1898, LXI, p 323
119 Philadelphia Monthly Med Journ, 1899, I, p 569
120 Bulletin of the Johns Hopkins Hospital, 1899, X, p 134
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cultures, which were entirely typical. The patient died but unfortunately no autopsy could be obtained. There was no evidence during life of free gas in the blood or the tissues. The case is of importance as demonstrating that gas-bacilli may be in the circulating blood for days in sufficient number to be demonstrable both microscopically and culturally without evidence of free gas. I have already expressed my suspicion that Achalme's anaerobic bacillus, which has likewise been cultivated from the blood, as well as from the tissues, of several cases of acute articular rheumatism, is identical with Bacillus aerogenes capsulatus.

Presence of Bacillus Aerogenes Capsulatus without Gas—In this connection I may say that the gas-bacillus may be present and even multiplying within the human body without the production of gas—Certain organs, above all the liver, offer much more favorable pabulum for the generation of gas than do others, but even in the liver the bacilli may be present without gas. I have found gas-bacilli in clumps within the spleen and kidney, surrounded by areas of necrosis, without recognizable gas ^{120a} I have already cited the demonstrations by Cushing and by Pratt and Fulton of the gas-bacillus in small abscesses without gas, the observation of the latter being particularly complete and satisfactory—Rist¹²¹ has cultivated the gas-bacillus (Bacillus perfringens) from cases of fetid otorrhoea and of mastoid abscess. He does not mention the presence of gas in these cases. I have already cited his isolation of this bacillus from the gall-bladder which contained no gas

Dr Harris in my laboratory isolated the gas-bacillus in pure culture from an abscess containing blood and pus in the neck of a dog, following an operation on the jugular vein There was no

¹²⁰a Cesaris-Demel's (loc cit) opinion that generation of gas in the tissues is merely a putrefactive process pertaining not to any particular kind of microorganism but to irreparable necrosis or damage of the tissues, whereby they become the prey of indifferent gas-producing bacteria, is not proven by his own observations and is opposed by many facts described in this paper

¹²¹ These, Paris, 1898

gas in the abscess. Aerobic cultures were entirely negative. These observations, however, are not the only ones demonstrating that the gas-bacillus may under certain circumstances and in certain situations manifest pyogenic capacity.

Meningitis. Pyogenic Capacity of Bacillus Aerogenes Capsulatus.—Howard, 122 in April, 1899, reported a case of acute fibrino-purulent meningitis, following operation for urethro-perineal fistula. Bacillus aerogenes capsulatus was found in pure culture in the meningeal exudate. Likewise Hitschmann and Lindenthal¹²³ have recorded another convincing example of acute cerebral meningitis, following fracture of the occipital bone, in which the gas-bacillus was found unmixed with other bacteria. These authors call attention to the pyogenic power of the gasbacıllus when it attacks the meninges, but, as already shown, the same power may be manifested elsewhere.

Cavities in the Brain.—Finally I would call attention to Reuling and Herring's¹²⁴ and Howard's studies of cavities in the brain produced by Bacillus aerogenes capsulatus and to the light which their observations shed upon certain obscure examples of cerebral cavities previously reported.

In this excursion into pneumato-pathology I have invited you to the survey of fields comparatively new and little trodden. I can only hope that our journey has been not without some interest and some profit to you. To me the opportunity to present before such a body as the Massachusetts Medical Society the results of these investigations is one which I highly appreciate.

I desire in closing to pay my tribute of respect and to call to your grateful remembrance the founder of this lectureship, Dr. George Cheyne Shattuck That the subject of this address would not have been without interest to him may be inferred from the title of his first Boylston Prize dissertation on the

¹²² Bulletin of the Johns Hopkins Hospital, 1899, X, p 66

¹²³ Op cit

Bulletin of the Johns Hopkins Hospital, 1899, X, p 62

theme propounded in 1806 and entitled. "The difference between mortification produced by an external cause and that which is produced by a constitutional defect, the diagnosticks and proper mode of treatment of each." By his noble character, professional services and liberality Dr. Shattuck deserved well of the medical profession of his city and state, and, indeed, of the whole country, and his memory is worthily perpetuated not only by the foundation of this lectureship but also by the endowment of the chair of morbid anatomy in the Harvard Medical School.

125 Published in Boston in 1808



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